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DESERT EXPRESS: AN ANALYSIS ON IMPROVED CUSTOMER SERVICE

THESIS

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AFIT/GLM/LSM/91S-64

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Presented to the Faculty of the
School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

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September 1991

Approved for public release; distribution unlimited

Preface

The purpose of this study was to analyze the Desert Express transportation system. Military customers desired a more responsive system to move the highest priority parts and equipment ("show stoppers") from the CONUS to the theater. Desert Express offered that responsiveness.

The analysis involved use of the case study method. While there was ample quantitative data available, the empirical evidence provided by senior transportation and logistics representatives (from both the customer and system operator viewpoints) provided an interesting perspective on the pulse of the system. Assessments of Desert Express by the interviewees were very positive. Customers were extremely pleased with the improved movement time for priority shipments to the Gulf region.

In undertaking this study, there are many individuals and organizations that provided assistance. I am very grateful to my thesis advisor, Lt Col Robert E. Trempe for his patience and encouragement while I was completing this project. Other individuals and groups that provided much assistance: Col James Sledge (HQ AFLC/LGT) for recommending this study and providing his expertise in transportation; Maj Vicki Mann and her staff at the Shippers Service Control Office for their assistance in providing data; Capt Jim Heatherton (HQ AFLC/LGTX); Capt Rich Trembley (HQ 21 AF), CMSgt Arthur Livermore (HQ TAC/LGT); Lt Col Ed Melcher

(WRALC/LGT); and the men and women of the 437 Aerial Port Squadron (Charleston AFB, SC) and the Warner-Robins ALC/LGT directorate for "rolling out the red carpet" at their respective locations when I visited each place to conduct research. My heartfelt thanks to each person. Last, but certainly not least, I owe a deep debt of gratitude to my wife, Debbie, and my three daughters for their patience, understanding, and lack of vacation trips while I spent many hours on the computer to complete this study.

Thomas C. Thalheim

Table of Contents

List of Figures

List of Tables

AFIT/GLM/LSM/91S-64

Abstract

Operation Desert Shield/Storm provided an opportunity to test the planning for U.S. forces to operate in a low intensity conflict. Both operations provided the opportunity for the logistics community to observe how the support forces provided required supplies to forward combat forces.

In response to customer requests, the U.S. Transportation Command created Desert Express, a daily "package express" flight from Charleston, SC to Saudi Arabia. The research question addresses the "how" and "why" of Desert Express. Additional investigative questions cover the following: mission objectives, planners' and customers' expectations, system performance, and implications on the Defense Transportation System.

The best and foremost finding was the success of the Desert Express system. Equally important, the customer perceived that the system worked. Processes that evolved during mission execution have applicability in the day-to-day peacetime environment.

The mission of Desert Express was no different than other MAC frequency channel missions. This mission highlighted difficulties in the transportation priority system that have existed for many years. Two possible

solutions: 1) educate and train all customers on the supply and transportation priority system or 2) totally revise the process for establishing shipment priorities to eliminate priority abuse.

DESERT EXPRESS: AN ANALYSIS ON IMPROVED CUSTOMER SERVICE

I. Introduction

Background

Desert Shield and Desert Storm operations provided examples of the type of warfare that the United States has confronted (for the past 30 years) and will likely encounter in the future: low intensity conflict (Parker, 1990:1). The Department of Defense (DoD) has defined low intensity conflict as:

> A limited politico-military struggle to achieve political, social, economic, or psychological objectives. It is often protracted and ranges from diplomatic, economic, and psychosocial pressures through terrorism and insurgency. Low-intensity conflict is generally confined to a geographic area and is often characterized by constraints on the weaponry, tactics, and the level of violence. Also called LIC. (JCS Pub 1, 1987:214-215).

Dupuy, et. al., contrasts low intensity conflict, or "minor contingency," with other forms of warfare:

> A minor contingency is a military operation involving armed hostilities (other than major wars) limited in time (no more than six months) and space (a maximum radius of 1000 kilometers). A minor contingency consists of one or more engagements or actions and can include 1) significant local wars (limited in time and space as specified above), or 2) discrete, limited campaigns or operations within such wars; or 3) any minor hostilities (limited as specified above) (This definition of military planning for a minor contingency does not include peacekeeping or shows of force, inasmuch as these do not involve hostilities). (Dupuy, et al, 1986:57-58).

This is the opposite end of the spectrum from the philosophy of massive retaliation predominant in the 1950s and 1960s.

Combat Logistics Support. The inclination toward reducing overseas forces places a greater burden on the logistics system to move continental U.S. (CONUS) forces and support personnel and equipment quickly to a theater. Airlift becomes a major factor in rapid force movement. Once the forces are in place, the logistics system must then provide these forces with the additional supplies and equipment to maintain combat readiness. Lt Col Dennis E. Welch, in a study entitled: Does an Achilles Heel Exist in Movement Control for a Theatre of War?, asserts that in future conflicts, the supported commander-in-chief (CINC) planners will assume that airlift is the primary sustainment transportation mode (Welch, 1989:29). This could be seen, to a certain extent, in the Grenada and Panama operations. It is assumed (and evident from Desert Shield cargo backlog data), that airlift was critical to rapid deployment and subsequent force build-up support during the early days of Desert Shield. The synergy of combat and logistics forces received a crucial test with the events of Desert Shield and Desert Storm.

The Combat Logistics Pipeline

From the customers' point of view, Desert Express provided a vital service during both the force deployment and build-up mode and the sustainment mode during the hostilities. Desert Express was a daily mission, to the gulf region, designed to provide express transportation for the highest priority parts and supplies. The pipeline for the highest priority parts, with Desert Express as the transportation "anchor," was more effective than the current procedures for moving high priority requisitions. Figures 1 and 2 depict a flow chart of that pipeline.

The process started with a need for a part to complete repair and place a piece of warfighting equipment into operation. Maintenance personnel requisitioned the part from Supply. If the part is not available locally or laterally (from another unit), supply would request the part from the deployed unit's home Supply. The request was channeled through the Consolidated Supply Support Agency (CSSA), operated by Central Command- Air Force/rear (CENTAF/rear). The CSSA computer determined the source to fill the requisition: a base, a depot, or contractor. The

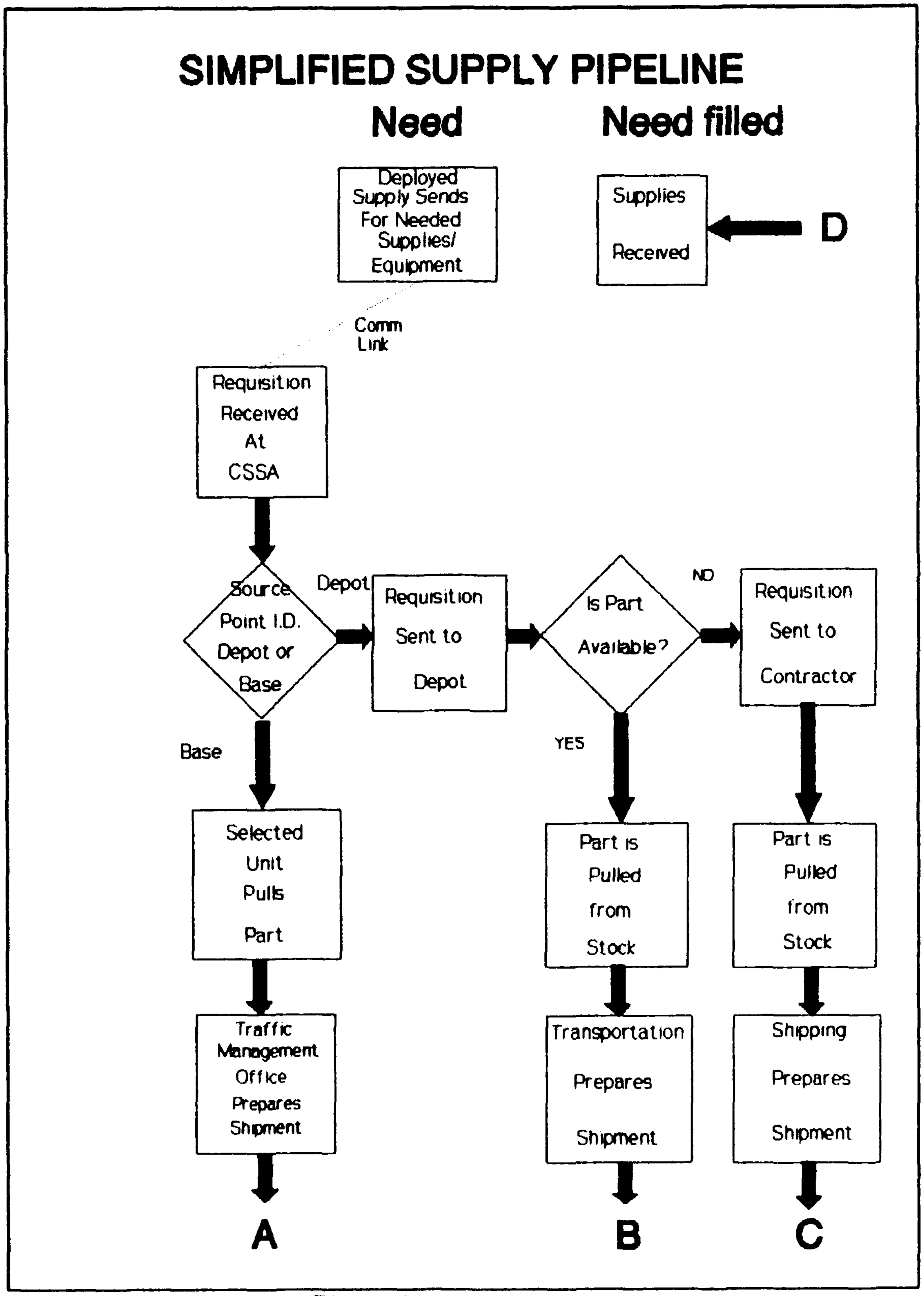

Figure 1. Pipeline Flow chart

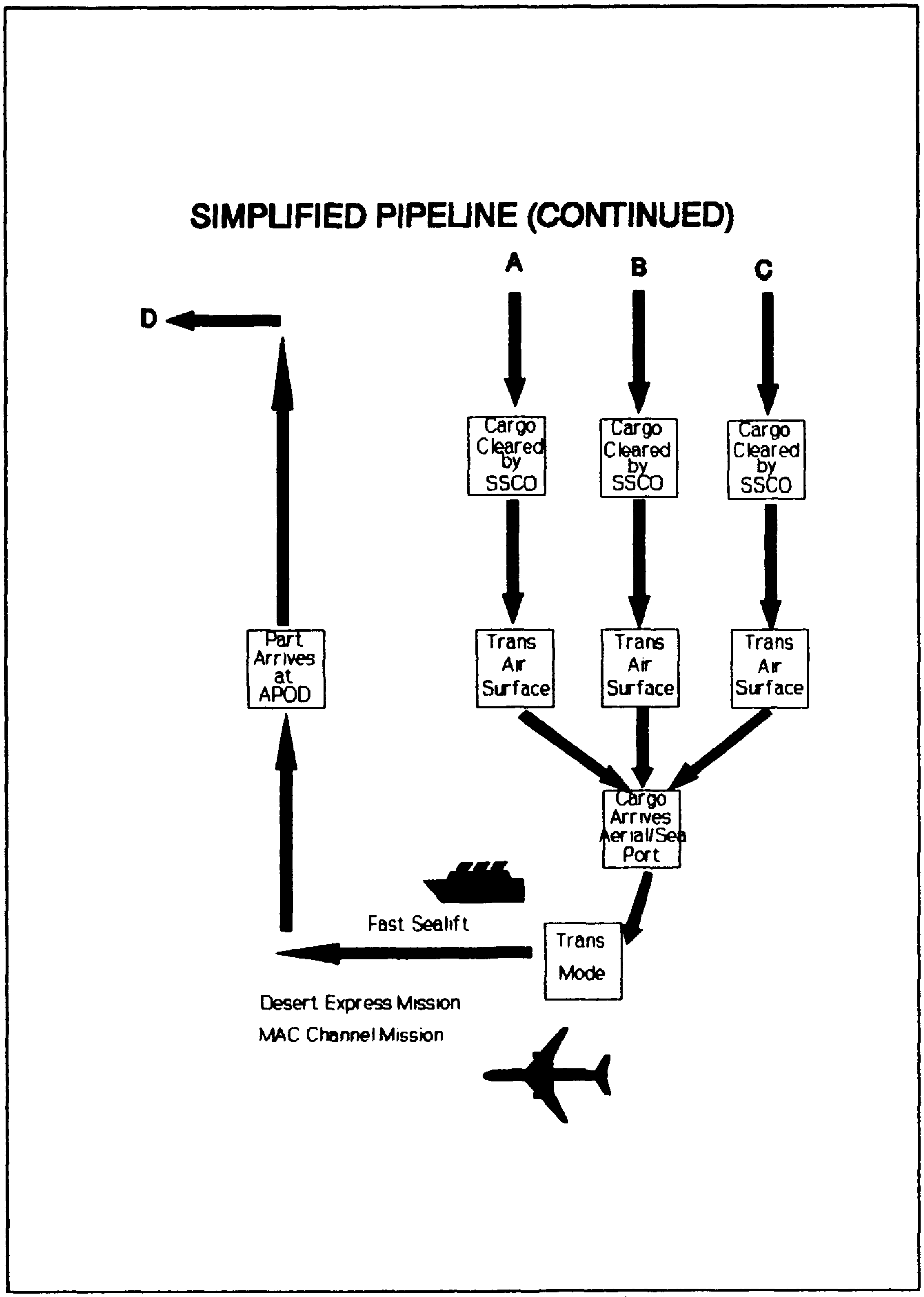

Figure 2. Pipeline Flow chart (Continued)

computer generated the requisition based on communication from the deployed supply organization (Grove, 1991). The selected source filled the requirement and sent the shipment to the deployed unit.

If the depot was identified as source, it filled the requisition from available stock or negotiated with a contractor to fill the requirement (in the case of unique, low-demand parts not readily available at the depot). For example, during Desert Express Warner-Robins Air Logistics Center tasked contractors to fill a total of 95 requisitions for high priority parts (Ellington, 1991).

Transportation. If the depot has the requested part available, the transportation division properly packs, labels and assures complete documentation. Under the Military Standard Transportation and Movement Procedures (DoD 4500.32R-- MILSTAMP), the part is tendered to Transportation with the priority established by the Uniform Materiel Movement and Issue Priority System (UMMIPS). Table 1 is a matrix for determining shipment priority.

The acronym FAD is the Force Activity Designator. This is assigned and controlled by the Joint Chiefs of Staff. It indicates the relative importance of a supported weapon system to the overall DoD mission. The acronym UND is the Urgency of Need designator that signifies the varying degree or importance of fulfilling a customers order (Westfall, 1991:7-4 - 7-5). The codes and their meanings are (Westfall, 1991:7-4 - 7-5):

Table 1. UMMIPS Priority Designators (Westfall, 1991:7-5)

		UND		
		A	B	C
FAD	I	1	4	11
	II	2	5	12
	III	3	6	13
	IV	7	9	14
	V	8	10	15

FAD	Meaning
I	This designator is not used in peacetime. It refers to forces in combat and is assigned by the SECDEF upon JCS recommendation
II	These are CONUS combat ready forces (ready for immediate deployment within 24 hours), or direct combat ready support forces deployed outside of the CONUS.
III	Other combat ready forces outside of the CONUS not in FAD II, or CONUS units ready to deploy in D+30 days.
IV	Forces ready to deploy in D+30 to D+90, or programs for the planned improvement of defense or national objectives.
V	All other U.S. forces and activities.

UND	Meaning
A	The item is needed to correct a situation that may preclude the accomplishment of the assigned mission or for emergency repair of the primary weapon system.

B The item is needed immediately, but the mission is impaired, not stopped without the item, or for repair that can be delayed temporarily.

C Priorities not covered by UND A or B, such as routine stock replenishment, depot base support, and routine depot distribution.

Once the supply system priority is set, the item is tendered to the traffic management officer (TMO) to send. The supply priority given to the item determines the transportation priority the item receives. That priority also determines whether the part moves by airlift or surface (ground vehicle or sealift). The TMO applies the transportation priorities based on the accompanying supply documentation.

Table 2 is a matrix for determining transportation priority. For example, if a specific requisition has a UMMIPS priority 2, the equivalent transportation priority is TP 1. The UMMIPS time standard for this shipment (order and shipping time) is 12 days (to the Mediterranean, which includes the Gulf region). MILSTAMP does not designate a specific Middle East area in the UMMIPS time standards matrix. Airlift is the recommended shipment mode (DoD 4500.32R, 1987:2-B-29). Actual time from request to part receipt can take longer than 12 days, the average being 18 days during Desert Shield (Sledge, 1991). A probable customer question: In a contingency condition, is 12 to 18 days an acceptable amount of time to wait in order to make an aircraft operational (especially if that aircraft is grounded for the needed part)?

Table 2. Transportation Priority Matrix (MILSTAMP)

SUPPLY/TRANSPORTATION PRIORITIES

Transportation Priority	UMMIPS Priority	Recommended Shipment Mode
1	01 - 03	Air
2	04 - 08	Air
3	09 - 15	Surface
4	TP - 3	MAC Space A

General Issue

The August 1990 developments in the Persian Gulf, Iraq's domination of Kuwait and the rapid deployment of US forces to that region, have highlighted the need for rapid force response. It also highlighted the criticality of combat logistics to provide support for these forces. There are two areas of support to consider: immediate bed down needs at a bare base (deployment), and possible sustainment (resupply) support. Desert Shield was in essence a bare base operation. There was no prepositioned equipment in Saudi Arabia itself (Elam, 1991); however prepositioned equipment was available in the area of responsibility (AOR) (Sledge, 1991). It was not practical or possible for a unit to have everything it required to set up and begin training and surveillance operations. Therefore, deployed units requisitioned these items from fixed bases, either the unit's home base or from the closest fixed base with the required supplies or equipment.

Resupply. Once the deployed forces were in position and combat-ready, the logistics support system, in theory, changed from a deployment mode to a resupply mode. During Desert Shield, Air Force units commenced flight training operations; inevitably, maintenance forces would use parts in the War Reserve Spares Kits (WRSK). When supply issued a part from the WRSK, it would requisition a like item. Additionally, any consumable requirements had to be ordered through supply.

For mission capable (MICAP) or 999 items, the customer has an immediate need; the customer expects supply to have the item or be able to quickly procure it. The pipeline must be responsive to these needs.

The DOD/NATO definition of resupply is: "The act of replenishing stocks in order to maintain required levels of supply." (JCS Pub 1, 1987:111). Dupuy defines resupply as:

> (the method) to furnish a force, organization or the like with supplies, or to replenish supplies or equipment that have been consumed, lost, destroyed, or damaged..." (Dupuy, 1986:187).

Sustainment. Sustainment is a different phase within combat logistics, with activities very similar to resupply. The fighting units are engaged in combat and will require consumable and reparable items, a myriad of equipment and supplies. The DoD defines sustainability as:

> The ability to maintain the necessary level and duration of combat activity to achieve national objectives. Sustainability is a function of providing and maintaining those levels of force, material, and consumables necessary to support a military effort...The 'staying power' of our forces, units, weapons systems, and equipment, often measured in numbers of days (JCS Pub 1, 1987:357 & 229).

From August 1990 through the beginning of Desert Storm, the logistics system operated in a combined deployment and resupply mode (Waggoner, 1991). This placed an additional burden on the airlift system. MAC was flying a total of 300 missions a day during the initial force deployment. By the beginning of November, MAC was flying about 150 missions a day (Morley, 1991). There were some deployment actions taking place, along with resupply missions. Both "operations" were competing for the same airlift resources (Waggoner, 1991). When Desert Storm operations began on 16 January 1991, the logistics system moved (by definition) into a sustainment mode.

The Air Force Pipeline. Inherent with the logistics pipeline are supply requisitions (with the related supply priorities) and the transportation of those supplies from the source. In theory, the most urgently needed items ("show stoppers") should have top priority in the Air Force supply system and in the Defense Transportation System. History and recent events in the Gulf region, indicate the priority system was not functioning as intended. The difficulties came in moving the most urgently needed items to the forward area of responsibility (AOR). For example, during the initial phases of Desert Shield, priority items under JCS project code 9BU, that should have moved from the consignor to the consignee in 12 days, took as much as 18 days or more (Sledge, 1991). In a situation where time was crucial to get (for example) an aircraft combat operational, 18 days may not have been acceptable.

In a dramatic change of policy, the U.S. Transportation Command (USTRANSCOM), through the Military Airlift Command (MAC), responded with Desert Express, a military version of Federal Express or DHL International overnight package express concept, available to each service component. The concept was proactive. Current military regulations and guidelines do not address this form of rapid transportation.

Specific Research Question

There was an apparent need for a change in operating policy in moving "show stopper" cargo to the area of responsibility (AOR)-- thus the formation of Desert Express. The question for research: How and why did Desert Express come about? The research strategy will examine the events surrounding the service formation, the policies that evolved, and the procedures implemented.

Investigative Questions

In analyzing the question, the following are questions of interest:

1. What were the objectives in forming Desert Express?

2. Has the system worked as planned or expected? How did the performance compare with other Desert Shield/Desert Storm logistic operations?

3. Did Desert Express performance match planner's expectations?

4. What were the implications of the Desert Express experience for the entire Defense Transportation System?

Scope

The scope for this research focuses on the Air Force as it interfaces with Desert Express, both as a major user and the system airlift operator. The four service components used this express service to varying degrees; the expected largest customer was the Army with the Air Force being the second. While the focus is on the Air Force, observations from Army officials and Army usage data are included. One assumption, based on interpretation of quantitative data: the other services encountered (in varying degrees) the same problems with cargo documentation and priorities as the Air Force.

II. Methodology

Introduction

The research question of interest is: How and why was Desert Express initiated?

The research question asks both "how" and "why." Both question types are "explanatory" and lend themselves to the use of case studies, experiments, and histories as preferred research methods (Yin, 1984:18-19). Robert K. Yin states that such explanatory questions deal with "...operational links..." (or policies in this particular case) that require tracing over a period of time, opposed to "...mere frequencies or incidences" (Yin, 1984:18). For this research question, the case study examines the thought processes that top military transportation policy-makers used in planning and executing the Desert Express concept.

Case Study Defined

Sharan B. Merriam defines the case study as:

> ...an examination of a specific phenomenon such as a program, an event, a person, a process, an institution, or a social group. The bounded system, or case, might be selected because it is an instance of some concern, issue, or hypothesis (Merriam, 1988:9-10).

A key question: is the system being studied, identified as a bounded system? The choice of using a case study depends on if one can focus on a bounded system (Merriam, 1988:9).

Merriam also cites D.B. Bromley's definition of a case study:

> (Case studies) get as close to the subject of interest as they possibly can, partly by means of direct observation in natural settings, partly by their access to subjective factors (thoughts, feelings, and desires), whereas experiments and surveys often use convenient derivative data, e.g., test results, official records. Also, case-studies tend to spread the net for evidence widely, whereas experiments and surveys usually have a narrow focus (Merriam, 1988:28).

The case study of Desert Express fits this definition.

Yin cites Schramm's observation on using the case study method:

> ...the essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result (Yin, 1984:22-23).

Yin emphasizes some key terms as the focus of case studies: "decisions," "organizations," "processes", "institutions," and "events." His technical definition:

> A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used (Yin, 1988:23).

Case Study Design Format

Kathleen M. Eisenhardt and Yin present methods for conducting research using the case study method. Eisenhardt's method consists of seven steps: 1) define the question; 2) select the appropriate cases; 3) collect data; 4) analyze the data; 5) formulate the hypothesis (hypotheses); 6) compare/contrast the hypotheses with contemporary literature; and 7)"...reaching closure..." or proving/disproving hypotheses (Eisenhardt, 1989:533).

Limitations. There are significant limitations with this design for this case. The primary limitation is only one case for analysis, which limits cross-case analysis for trends or dissimilarities. The trends, or lack of trends, provide a basis for proving/disproving hypotheses. The use of one case can also open validity issues. However, by examining cargo operations at Dover AFB, Tinker AFB, and NAS Norfolk (which handled general, lower priority air shipments to the Gulf region), there was a basis for comparing Desert Express with other operations within the airlift segment of combat logistics. The other limitation concerns literature comparison. There is little literature available on Desert Shield/Desert Storm and the role of combat logistics (especially Desert Express). The Gulf War was the first test of rapid major force deployment; this case study analyzes a previously uncharted course.

While the Eisenhardt method outline is more appropriate for a research question consisting of multiple case studies, there are important applicable areas of concern for this research question.

Multiple Data Collection Methods. The use of different data collecting methods allows triangulation of the data sources. Triangulation literally means: "...operation for finding a position or location by means of bearings from two fixed points a known distance apart" (Woolf, 1974:1247). For case studies, this involves formulating inferences from similar trends appearing in multiple data sources. Similar trends render strong substantiation to the proposed hypotheses or constructs (Eisenhardt, 1989:538). Triangulation also provides a form of external validity to the research.

Combining Qualitative and Quantitative Data. The case study method is useful when the data is predominantly qualitative. A major pitfall with using the case study method is the investigator can allow "...equivocal evidence..." or biased views to influence the course of findings and conclusions (Yin, 1984:21). The insertion of quantitative data may provide the researcher with relationships not readily evident in the qualitative data. Eisenhardt cites Jick (1979) on the value of quantitative data with qualitative data:

> It...can keep researchers from being carried away by vivid, but false, impressions in qualitative data, and it can bolster findings when it corroborates those findings from qualitative evidence. The qualitative data are useful for understanding the rationale or theory underlying relationships revealed in the quantitative data or may suggest directly theory which can be strengthened by quantitative support (Eisenhardt, 1989:538).

For this case study, quantitative data will be examined to determine if this information was a major player in the policy formulation surrounding Desert Express.

An Alternative Design. Yin discussed a research design that incorporated five elements: 1) the research question; 2) the propositions (if any); 3) the unit(s) of analysis; 4) the logic that joins the data to the propositions; and 5) the criteria for finding interpretation (Yin, 1984:29). This format was used in conducting this case study.

Case Design Method

In applying Yin's design outline, the research question has already been established. Propositions (or hypotheses) to consider:

1). The goal of Desert Express was to (in effect) by-pass the established transportation priority system in order to move high priority cargo quickly.

2). The goal of Desert Express was to provide improved time and place utility for the customer; in this case the deployed combat units.

3). The current transportation priority system does not readily distinguish high-priority cargo marked for simultaneous DoD project codes.

4). The Desert Express system should be implemented into the Defense Transportation System (DTS) in both contingency and peace time environments.

Unit of Analysis. The unit of analysis is established by the primary research question (Yin, 1984:31). As this case involves a program, extra care must be exercised. Yin warns that case studies on decisions, programs, implementation processes, and organizational changes have a "trap"-- the difficulty in defining the case in terms of the case beginning and case end points. For example:

> ...a case study of a specific program may reveal a) variations in program definition, depending upon the perspective of different actors, and b) program components that preexisted the formal designation of the program. Any case study of such a program would therefore have to confront these conditions in delineating the unit of analysis (Yin, 1984:31).

The beginning point for this case was 6 August 1990, when the President approved the deployment of American forces to defend Saudi Arabia (Woodward, 1991: 273). The end point for this case was 20 May 1991, when the last Desert Express mission flew (Morley, 1991; Mann, 1991). The events, formulated policies, and procedures implemented were examined. Interviews, conducted with individuals in key policy-making decisions, comprise the qualitative data used to provide answers or conclusions concerning the research question.

Investigative Questions

Data was linked to the investigative questions in order to ascertain conclusions or implications of the Desert Express system.

Question 1. What were the objectives in forming Desert Express? Personal and telephone interviews and electronic message traffic furnished qualitative data to provide insights to this question.

Question 2. Has the system worked as planned or expected? How did the performance compare with other Desert Shield/Desert Storm logistic operations? There are several possible performance measures on the system effectiveness. Quantitative data on Desert Express aircraft allocation utilization, amount of cargo moved, order and ship times for cargo for DoD project codes 9AU and 9BU, and cargo backlogs at four aerial ports (for both Desert Express and "routine" Desert Shield/Desert Storm support) provide system measurement possibilities. A cargo backlog could have been the result of actions of two processes: 1) influx of cargo to the aerial port and 2) airlift scheduling. Cargo influx did exceed available airlift at two of the four aerial ports with channel missions to the AOR, causing cargo backlogs. For Desert Express, DTS managers took extraordinary actions to limit backlogs. This could be a critical measure of success. Interviews with transportation representatives and customer representatives provide qualitative findings on how decision makers defined system effectiveness.

Question 3. Did Desert Express performance match planner's expectations? Desert Express introduced a unique situation to military transportation-- an overnight package express. Mission success was analyzed in two aspects-- the actual quantitative effectiveness measures and the customer's perception of success. Interviews with customer representatives and "feedback" to transportation officials provided indication of successful mission performance. The quantitative measures, mentioned above, also provided some indications of success.

Question 4. What were the implications of the Desert Express experience for the entire Defense Transportation System (DTS)? This question examines the results of the investigative questions as they apply to the DTS. Additional questions concerning the entire transportation system, could lead to areas requiring further study. Some of these questions will be addressed.

Each of the investigative questions will be examined in succeeding chapters: Chapter 3 discusses the background surrounding formation of the Desert Express mission; Chapter 4 addresses the evolution of the system; Chapter 5 addresses the research findings; and Chapter 6 evaluates the "lessons learned", implications, and areas for further research.

III. Events Surrounding Desert Express Formation

Introduction

This chapter examines the events that provided impetus for Desert Express. The chapter will also look at the logistics support during the rapid deployment of American forces to Saudi Arabia and the resupply effort under Operation Desert Shield.

Background

The events that brought Desert Express into reality started taking shape on 16 July 1990 when the senior civilian Middle East intelligence expert in the Defense Intelligence Agency (DIA) noted (from satellite photographs) unusual military movement in Iraq. The Iraqis had a tank brigade (T-72 tanks) in Southeastern Iraq. Photos also revealed equipment belonging to the Republican Guard (an elite Iraqi military unit) being loaded on rail cars for movement. The intelligence expert wanted more evidence before raising alarms to senior military and government officials. Satellite photographs taken on 17 July 1990 provided even more signs, to the expert, that President Saddam Hussein intended to employ force for a purpose. Intelligence reports went to senior military officials (Woodward, 1991:205-206).

With the U.S. government and military watching, Hussein continued building force level near Kuwait. At the time of

Hussein's move into Kuwait, there were an estimated 100,000 Iraqi troops massed in southeastern Iraq (Woodward, 1991:217).

Beginning Operation Desert Shield

On 2 August 1990, Saddam Hussein's army invaded neighboring Kuwait. In 11 hours, he had control of Kuwait City. Reaction to this was also swift. In response to Saudi Arabia's request for help, the United States sent military forces to Saudi Arabia. Assistance came in the form of the 82nd Airborne Division and two F-15 fighter squadrons (the beginning phase of Operation Desert Shield). Logistics support was critical to this display of military force (Nelan, 1990:30). Military transportation organizations and service components' depots prepared to support deployed forces. The logistics support pipeline "shifted gears" to resupply mode. A potential problem evolved: how would the Defense Transportation System (DTS) handle the transition from a peace time mode to a deployment resupply (and possible contingency) mode?

The logistics system quickly changed from the "peacetime mode" to deployment support. The initial deployment continued throughout Operation Desert Shield. By August 11, the Defense Logistics Agency (DLA) notified the military community that communications with DLA agencies should be limited to "life or death" requisitions and Desert Shield requisitions only (AFMLO msg, 111635Z August 1990).

There was also a reminder to use the proper Joint Chiefs of Staff (JCS) project code for requisitions for Desert Shield: 9BU. The implicit reminder to all shipping agencies was that proper use of Military Standard Transportation and Movement Procedures (MILSTAMP) documentation was essential to rapidly move resupply cargo to the Area of Responsibility (AOR). The Military Traffic Management Command, Western Area quickly echoed the need to use the assigned project code to expedite cargo shipments to the AOR (CDR MTMCWA msg, 111850Z August 1990).

Once the initial deployment was well underway, Military Airlift Command (MAC) established three military installations to be the Aerial Ports of Embarkation (APOEs) for Desert Shield: Dover AFB, Tinker AFB, and Naval Air Station, Norfolk. Three resupply cargo and passenger channels were also established:

1. Dover-Dhahran (Saudi Arabia)-Bateen (United Arab Emirates)

2. Tinker-Riyadh (Saudi Arabia)-Cairo International (Egypt)

3. Norfolk-Sigonella (Italy)-Jeddah (Saudi Arabia)-Bahrain (Saudi Arabia) (HQ MAC msg, 050754Z August 1990).

<u>Cargo Backlog</u>

The number of requisitions from the AOR rose significantly. On 24 August, transportation officers on the Air Staff noted from a U.S. Transportation Command (USTRANSCOM) message, that a significant number of non-unit personnel and a significant amount of non-unit cargo was arriving at the APOEs without the required MILSTAMP documentation. Additionally, cargo arrived without proper hazardous cargo labeling required by AFR 71-4 (Air Force), TM 38-250 (Army), NAVSUPPUB 505 (Navy), MCOP 4030.19-E (Marine Corps), and DLAM 4145.3 (Defense Logistics Agency)--Transportation of Hazardous Materials. Aerial port personnel had to divert their attention to cargo documentation problems. The increased workload, time, and number of personnel required to route non-complying cargo to the Airlift Clearance Authority (ACA), became a constraint in the air cargo movement system (HQ USAF/LEYT msg, 242116Z August 1990). HQ AFLC followed with a message that emphasized that Desert Shield logistics support was in a resupply phase and not a deployment phase. Cargo required the proper MILSTAMP documentation before entering the airlift system. Shipments not complying with these directives would be turned over to the Airlift Clearance Authority (ACA) or Military Air Terminal Coordinating Unit (MATCU) servicing the APOE. This process would add to the cargo transit time. (HQ AFLC msg, 242255Z August 1990).

Another problem rapidly developed-- intransit cargo visibility. The Shipper Service Control Office (SSCO), at HQ AFLC, was charged with the responsibility of controlling the flow of cargo into the CONUS APOEs. To maintain that control, HQ AFLC/DSTL requested a copy of the cargo portion of the daily MAC DCS/Air Transportation briefing to determine the daily cargo backlog at the APOEs (AFDCO/DSTL msg, 250715Z August 1990). This indicates a problem with the interface between data systems used by MAC and AFLC. AFLC transportation officials confirmed this difficulty (especially with the Desert Express mission) (Mann, 1990, Sledge, 1990).

As Desert Shield logistics support continued into September, the backlog of 9BU cargo (including high priority [999] cargo) continued to build at Dover. On 1 September 1990, HQ AFLC transportation directorate issued Air Force-wide guidance for moving non-unit cargo and personnel to the AOR through the APOE at Tinker AFB. The intent was to advance cargo as quickly as possible and avoid port saturation (HQ AFLC/DS/BS msg, 011944Z September 1990). By 13 September, AFLC provided additional guidance on airlift channel routing changes for routine channels effective 1 November 1990 (HQ AFLC/DSTB electronic mail, 13 September 1990). This implied an apparent need for the Dover APOE to concentrate on resupply cargo for Operation Desert Shield. Moving routine channel cargo to other APOEs would also aid in keeping this traffic moving. The 436th Aerial Port Squadron could concentrate its resources on resupply cargo to the AOR.

There was continuing difficulty with shipment documentation. AFLC/DS sent another message concerning non-unit cargo that arrived at the APOEs without the proper MILSTAMP documentation. Such cargo was being held (or frustrated) at the port until the deficiency was corrected. This added delay to overall movement time to the AOR. There was also a further reminder to use the Tinker APOE to send resupply material (HQ AFLC/DS/BS msg, 190144Z September 1991).

MAC was also aware of the congestion at Dover AFB. In a change to the routing guide for small unit and non-unit cargo and personnel supporting project code 9BU/Operation Desert Shield (number 7), MAC recommended that shippers west of the Mississippi River, use Tinker APOE and shippers east of the Mississippi River, use the Dover APOE. The rationale was to expedite surface movement of cargo in the continental U.S. (CONUS) to the APOE and to ease congestion at Dover. MAC was also planning increased airlift from Tinker to the AOR (HQ MAC/CAT msg, 202055Z September 1991). Figure 3 depicts the Desert Shield/Storm (9BU) cargo backlog at Dover from 28 August 1990 to 31 March 1991. The figure graphically depicts the increase of cargo during the Phase II deployment in November and December and significant increases at the beginning of the air campaign. On 25 September 1990, MAC issued further guidance on Southwest Asia channels that list both Dover and Tinker as APOEs. There were difficulties with shippers that were geographically closer to Tinker sending 9BU cargo to Dover. MAC strongly recommended shippers and service component shipment clearance offices to route cargo to Tinker APOE if

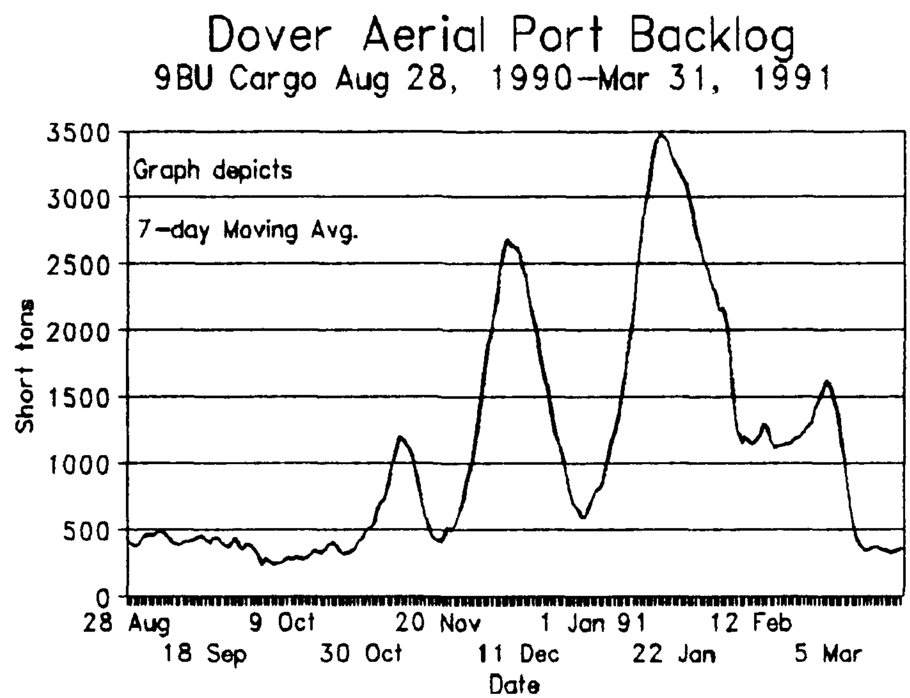

Figure 3. Desert Shield/Storm Cargo Backlog (HQ MAC/TRK)

the originating shipper was geographically closer to Tinker AFB (HQ MAC/CAT msg, 252238Z September 1991).

In October 1990, the transportation system, as well as the pipeline continued in a resupply mode. The commander of the Military Traffic Management Command (MTMC) issued directives to the Marine Corps that a modified version of their air cargo challenge program should be reinstated. The directives indicated that the program was suspended during the initial Desert Shield deployment phase. Basically, during deployment, all eligible airlift cargo (deemed mission essential) was airlifted. Since the pipeline system moved into the resupply mode, MTMC felt that the challenge system should be brought back to "...conserve scarce airlift resources..." (CDR MTMC msg, 091243 October 1991). This principle could be applied to all services.

On 12 October 1990, the commander, US Transportation Command (USTRANSCOM) proposed a premium transportation system to move the highest priority parts to the AOR. The concept was (and is) similar to Federal Express or United Parcel Service (small package air transportation). The concept (given in the next chapter) was totally new for the Defense Transportation System. It was a response to the customer's requirement, in this case the military components with units involved in the Desert Shield and eventually the Desert Storm operations.

IV. The Desert Express Mission

Introduction

Cargo backlogs at the major aerial ports handling Desert Shield cargo (DoD project code 9BU), were building. There was a problem moving 999 and "mission capable" (MICAP) parts to the Desert Shield area of responsibility (AOR). In response to a customer's request, transportation officials at U.S. Transportation Command (USTRANSCOM) envisioned a military air "package" express service that would handle only the highest priority supplies and equipment required by deployed units. This mission would fly on a daily basis. This chapter examines the birth and operation of Desert Express.

Desert Express Concept Background

As the Desert Shield deployment and resupply continued, senior transportation officials at USTRANSCOM began to examine the transportation system as it existed. The Army, through one of their helicopter units (based in St. Louis, Missouri), informed MAC and USTRANSCOM (co-located at Scott Air Force Base) that the transportation time for shipping 999 items to Saudi Arabia did not meet UMMIP standards and was unacceptable (Morely, 1991). USTRANSCOM officials recognized that the current peacetime supply and transportation priority systems were inflated (Thompson, 1991). Cargo that should move under an established lower military standard transportation and movement procedure (MILSTAMP) priority, was moving under a higher priority.

<u>Customer's Perceptions</u>

Such action resulted from a users' perception that the transportation segment of the deployment/resupply pipeline was not functioning properly; it used an inordinate amount of time to move equipment and supplies to the consignee. As noted, the supply priority is the determining factor in setting the transportation priority (DoD 4500.32R, 1987:2-B-29). To "improve" the system, a requisitioner may present acceptable justification for a higher requisition priority. With a higher transportation priority, a shipment should move through the DTS more quickly. The theory works well except when there is a large amount of cargo that is moving with the same priority. At this point, the priority system breaks down. The highest priority for Air Force cargo, 999, tells transportation personnel that the particular shipment must move quickly. In the transportation "world," 999 cargo for different project codes can come into the airlift system simultaneously. All 999 cargo receives the highest transportation priority-- TP 1. Should most of the shipments accepted into airlift system be the same priority, it creates a "no priority" condition (Sledge, 1991). Aerial port load planners will plan aircraft loads using a method similar to first-in-first-out. In theory, if the majority of the cargo at an aerial port is the same high priority, the system "breaks down." Cargo moves as airlift is available. It becomes possible for a 999 shipment to move in the same amount of time as a Transportation Priority (TP) 2 shipment, which has a time standard of 17 days to the western Pacific region (DoD 4500.32R, 1987:2-B-30). If the priority system does not work, true priority shipments will not arrive at the consignee's location in the UMMIPS time standards. In a force deployment, how can high priority shipments move, with minimal delay, through an aerial port that has a 2000 ton cargo backlog?

Concept Planning

The combination of foresight and desire to improve customer service was the impetus behind the idea of a premium transportation system designed to move the highest priority parts, very similar to Federal Express' operation.

Federal Express as Model. Federal Express founder, Fred Smith, created an air transportation system that moves high value, high priority small packages and documents from consignors to a central hub for sorting to final destinations. After sorting, all packages and documents are placed on respective flights to "spoke" centers for delivery to the final consignees. All movement and sorting activities occur during each night. Deliveries are made the following business day (Sigafoos, 1984:49-50). The concept is successful as Federal Express is considered a benchmark for the small package transportation industry (Solomon, 1990:9).

Desert Express Concept Details

Planners at USTRANSCOM desired to create a similar system for DoD high priority (999) cargo. Based on the supported CINC's directive, each service determined the types of parts, supplies, and equipment to be considered high priority. For the Air Force, such items were labeled "show stoppers." (Sledge, 1990; Mann, 1990; Heatherton, 1990). The name Desert Express came from the type of environment at the AOR and the concept of swift style delivery (Thompson, 1991).

Desert Express was designed to provide an "overnight" service for the highest priority cargo enroute to Desert Shield units. The first concept was to place a C-141 at Memphis, Tennessee (hub for Federal Express) or Louisville, Kentucky (hub for United Parcel Service) or Dayton, Ohio (hub for Emery Worldwide). The strategy was to create a "destination" named Desert Express (or similar terms) within the commercial carrier's database. Any packages in the commercial carrier's route network, would be sorted for departure on the C-141. After cargo loading, the aircraft would depart to the AOR. Plans called for inflight refueling, creating a non-stop flight (Wang, 1991). This process would save significant time over the current MAC channel airlift movement standard. This process was not adopted as there were aircraft maintenance and aircrew constraints (Thompson, 1991; Wang, 1991).

Two goals became paramount: 1) having a dedicated aircraft and crew to complete the overseas leg of the rapid delivery system and 2) the use of premium air express to get cargo from individual bases and depots to the "hub" for the military flight.

Charleston AFB Chosen APOE

The next planning concept involved the use of Charleston AFB as the hub for the Desert Express mission. One major reason: the base shares the runway with Charleston International Airport. The strategy was to have CONUS supply sources use commercial premium air transportation to move cargo to Charleston if military organic airlift, Air Force Logistics Air (LOGAIR), Navy Quick Transportation (QUICKTRANS), or surface motor carrier could not deliver cargo by the 10:30 A.M. cut-off time for cargo receipt at the Charleston AFB aerial port (Thompson, 1991). Commercial air express companies maintained operations at Charleston International airport.

Initial Aircraft Allocation

The next challenge: how to divide the allowable aircraft cabin load (ACL) among the four service components? There was no complicated mathematical formula in setting the initial allocation; it was an arbitrary decision: the service with the largest number of weapon systems in the AOR received the greater share of the aircraft allocation. The Army had the greatest number of weapon systems in the theater with the Air Force second, the Navy third and the Marine Corps fourth (Thompson, 1991). With the conversion factors of pallet weight- 3000 pounds, and measurement of 500 cubic feet, the following were initial allocations (USCINCTRANS/TCJ3-J4 msg 202246Z Oct 90):

Army	5 pallet positions; 15,000 lbs; 2500 cu ft
Air Force	4 pallet positions; 12,000 lbs; 2000 cu ft
Navy	2 pallet positions; 6,000 lbs; 1000 cu ft
Marines	1 pallet position; 3,000 lbs; 500 cu ft

The limitation on the cargo amounts for an individual flight forced each service component to look at two critical factors: 1) determining what items were considered highest priority and 2) ensuring the cargo met the allocated weight and cube specifications (Thompson, 1991). This introduced a basic question: what was defined as high priority cargo?

Show Stopper Cargo

With little additional guidance from the supported theater commander or from USTRANSCOM, each service component determined what constituted the highest priority cargo. For the Air Force, the term "show stopper" was coined. HQ AFLC Transportation Directorate (DST) worked with U.S. Central Command Air Force/Rear (CENTAF/Rear, Langley AFB, VA) to ascertain what items would be "show stopper." CENTAF/Rear coordinated a definitive list of items with CENTAF/Forward (in the AOR). The result was the following:

> ...items with an urgency justification code (UJC) of 1A (MICAP aircraft parts), 1E (MICAP communication parts), 1M (engine MICAPs), or specific item identified in the supported command's daily SITREP or LOGSTAT reports (HQ AFLC/DS msg, 231900Z Oct 1991).

Restricted Cargo. In addition to meeting "show stopper" criteria, there were further restrictions on the types and size of individual shipments. Non-accepted items included: courier material, aircraft engines, ammunition, "married pallets" with oversized cargo, and outsized cargo (which requires C-5 transportation). Restricting cargo size was advisable since in-theater transportation equipment handled smaller cube shipments (Mann, 1990; USCINCTRANS/TCJ3-J4 msg, 202246Z Oct 1990; HQ MAC/CAT msg, 290114Z Oct 90; HQ TAC/LGT msg, 291547Z Oct 90).

System Details

The Desert Express system is patterned after the commercial air express method of operation. In the commercial world (using Federal Express as an example), company couriers across the country pick up packages during the business day. All pick-ups are completed by a set evening hour (e.g., in Chicago, cut off time is 8:30 PM local) to complete package sorting. Once completed, all packages are taken to the airport for loading on a company aircraft (Sigafoos, 1984:19). As each aircraft arrives at the Memphis hub, all packages are down loaded and sorted for proper destinations. Once sorting is completed, ramp personnel quickly load each aircraft. Before dawn, all aircraft have departed the hub for each spoke destination. At the destination, packages are sorted for local couriers. Packages are delivered before 10:30 A.M. the next business day (Solomon, 1990:7).

For Desert Express, the planned cutoff time for cargo receipt at Charleston AFB coincided with the commercial air express 10:30 A.M. delivery time. The air express companies have early morning arrivals at Charleston International Airport. After completing local sorting, company couriers could deliver Desert Express cargo before the 10:30 A.M. deadline. The mission block time was 12:00 noon; departure time was 12:30 P.M. daily. (HQ AFLC/DS, 231900Z Oct 1991 msg, Reeves, 1991).

CONUS Shipment Requirements

Desert Express system planners and operators anticipated that cargo, accepted on Desert Express, would generally be small cube and light to medium weight items (similar to the package concept used by the commercial express industry). Rules of engagement stipulated that each shipment have the required MILSTAMP documentation and positive clearance by each service's designated shipment clearance authority. For the Air Force, the Shipper Service Clearance Office (SSCO) at Headquarters, Air Force Logistics Command (AFLC) performed clearance duties. Shippers were not allowed to forward any cargo to Charleston AFB without clearance. At the system start up, all clearance was accomplished telephonically. SSCO officials were soon to implement facsimile procedures for clearance (HQ AFLC/DS: 192300Z Oct 90).

A vital factor in the successful "overnight" delivery to the AOR concept was use of CONUS express transportation of cargo from a base, depot, or contractor to Charleston. The SSCO issued explicit guidance for intra-CONUS movement. For example, all cargo cleared for the mission on (for example) 15 November 1991, must be at the Charleston aerial port by 10:30 A.M. on 15 November. Any cargo (cleared for 15 November), arriving after the cut-off time, would be held at the aerial port until 16 November, with the concomitant reduction of the Air Force allocation on the 16 November mission.

Charleston AFB Preparations

The entire 437th Military Airlift Wing (MAW) mobilized the resources necessary to plan and execute the local operation of Desert Express. The wing received approximately one week notification prior to Desert Express start-up. As this was the first time that the Defense Transportation System (DTS) attempted to operate an overnight package delivery system, there was no military benchmark to use as a planning guide. The 437 MAW quickly brought together all the players required to prepare and launch the daily mission: air transportation, maintenance, operations and other support personnel (security police, services, etc.) (Donovan, 1991). SMSgt Thomas Donovan, the key Desert Express planner, coordinator, and supervisor for the 437 Aerial Port Squadron (APS), became involved in much of the wing planning for this mission. Planning meetings were patterned after Total Quality Management (TQM) Quality Circles (Donovan, 1991). Quality circles, in the production arena, are based on two important principles: 1) workers, on the production line, know where the problems are; they are the method by which solutions are implemented, and 2) "...two heads are better than one, and three are better than two" (Chase & Aquilano, 1989:207).

The planning meetings were the forum for experts to identify foreseeable and potential problems in launching the mission at 12:30 P.M., seven days a week. Examples of teamwork in solving potential problems included: 1) maintenance personnel parking the Desert Express aircraft on the flightline area as close to the air freight terminal as possible, 2) aircrews completing pre-departure checklists and holding engine-start to the last possible second to ensure the maximum number of shipments could be placed aboard the aircraft, and 3) aerial port personnel "streamlining" the process of accepting and palletizing cargo (Reeves, 1991). All of the wing activities improved Desert Express loading crews efficiency and effectiveness and allowed the flexibility to accept late arriving shipments from the commercial carriers (Donovan, 1991; Reeves, 1991).

Mission Preparation Strategies. As this transportation system was new, aerial port management attempted to use their standard operating procedures to plan and load cargo on the mission aircraft. During the beginning of operations, the shipment receipt totals were low. Even with the 10:30 A.M. cut-off for cargo arrival at Charleston AFB, the two hours before departure time were ample to complete predeparture preparations. Aerial port personnel placed cargo data into the ADAM III (the MAC cargo database), prepared the cargo manifest, and loaded cargo onto the aircraft with time to spare (Donovan, 1991). As time progressed and customers became more familiar with the system, the aerial port workload dramatically increased.

Aerial port management soon realized that conventional outbound cargo processing procedures did not allow the port to handle the increased number of shipments to place on pallets and load on the aircraft. Using a TQM approach, port management and port operations personnel (dedicated to the Desert Express mission) created and refined new procedures (and accompanying checklists). Effectiveness improved as operation personnel provided suggestions on improving individual tasks. Management and workers revised checklists at least nine times during the Desert Express operation. Worker participation in the decision-making process was one important element in maintaining a high esprit de corps among the mission participants (Reeves, 1991).

The new transportation system required new or unusual methods of operation. Conventional wisdom, for aerial port operation, dictates that load planners determine the outbound shipments, to be placed on pallets by destination and priority. The load planners then sequence cargo pallets into a proper aircraft load configuration. Once the pallets are loaded and "capped", material handling equipment move the cargo out to the aircraft for loading. All of this activity occurs in a three-to-six hour timeframe, depending on the aircraft being planned. For example, a C-5 requires more preparation work than a C-141. Desert Express "broke" all the rules. With the cut-off time being two hours prior to aircraft departure, cargo preparation, planning, and sequencing was very precise. If two commercial express companies delivered Desert Express cargo near the cut-off time, aerial port personnel had to move quickly and effectively to accomplish an on-time aircraft departure. The other key area was placing as many shipments on the daily mission as aircraft space and loading time would allow (Reeves, 1991).

Load planners used a standard weight of 3000 lb for each pallet. As the shipments were placed on pallets, the load planner simultaneously made up the aircraft manifest. As pallets were completed, or "capped", they were shuttled out to the waiting aircraft by forklift, one pallet at a time. While this process appeared inefficient (specialized material handling equipment, 40 K-loaders, move up to six pallets), it did allow extra processing time for cleared shipments, arriving after 10:30 A.M., to be placed on the mission. An aerial port goal was to include as many of the shipments on the mission as time would allow and maintain consistent departure times (Reeves, 1991). The cargo shuttling system was effective in two ways: 1) more shipments were placed on the aircraft than would be possible if the cut-off time was strictly adhered to, and 2) with the wing team cooperation, there were only four aircraft departure delays attributed to port operation. This statistic is more impressive when compared with the total number of Desert Express missions departures-- 235 (Morley, 1991). Colonel James I. Reeves, Commander, 437 Aerial Port Squadron, stated that the maximum number of "show stoppers" on each flight was much more important than an on-time departure reliability rate (Reeves, 1991).

One other notable innovation designed to improve customer service: the "mixed" thirteenth pallet. The C-141B aircraft has 13 cargo pallet positions. Service component allocations for the aircraft were based on 12 pallet positions being available for cargo; the thirteenth pallet position remained empty. The 12 cargo pallets were built with shipments of one service component (for example, an Army pallet would have all Army shipments) bound for the same aerial port of debarkation. In order to place more cargo on the daily aircraft and to limit potential cargo backlog, an additional mixed pallet with cargo, for all service components, was placed in the last pallet position of the aircraft. The additional pallet handled shipments arriving after the cut-off time (Reeves, 1991).

System Operation History

The first Desert Express mission launched on 30 October 1990. The final destination was Dhahran, Saudi Arabia with a refueling stop at Torrejon Air Base, Spain (Figure 4). As expected, there were initial difficulties as the entire DoD logistics community adjusted to the new transportation service. Utilization in the beginning was low, as depicted by Figure 5 and Figure 6, but increased as shippers became familiar with the system and the situation in the Gulf region continued to deteriorate. Figure 6 reflects utilization of the original mission (DE 1) and utilization of the additional Desert Express mission (DE 2). Both graphs use a 7-day moving simple moving average to eliminate "noise" in the data.

Additional Routing. By the request of Commander-in-Chief, Central Command (CINCCENT), on 7 November 1991, Desert Express routing would include Riyadh as an aerial port of debarkation. There was an assumption that customers would be better served if there were more than one port of debarkation (HQ MAC/TRK, 291800Z msg, 29 October 1990, HQ MAC/CAT, 060157Z msg, 6 November 1990)). From 30 October to

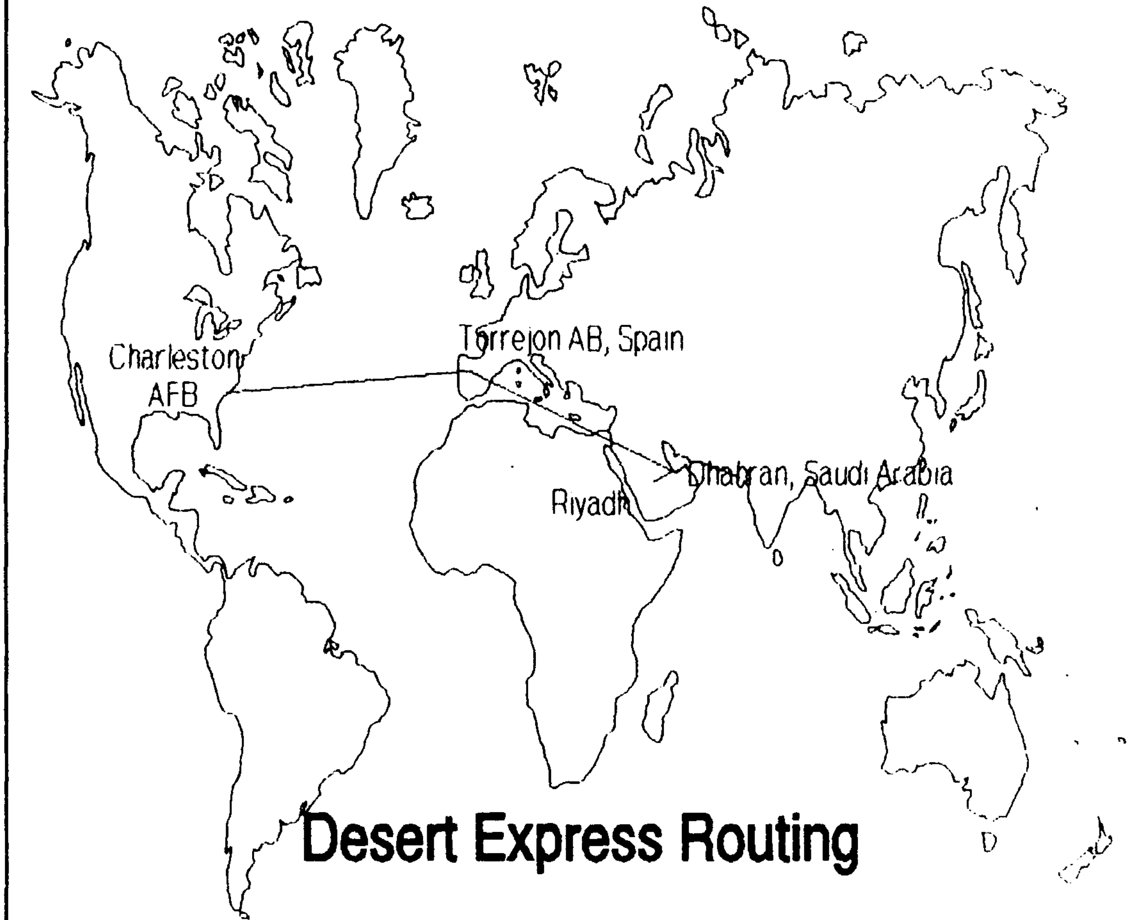

Figure 4. Desert Express Route

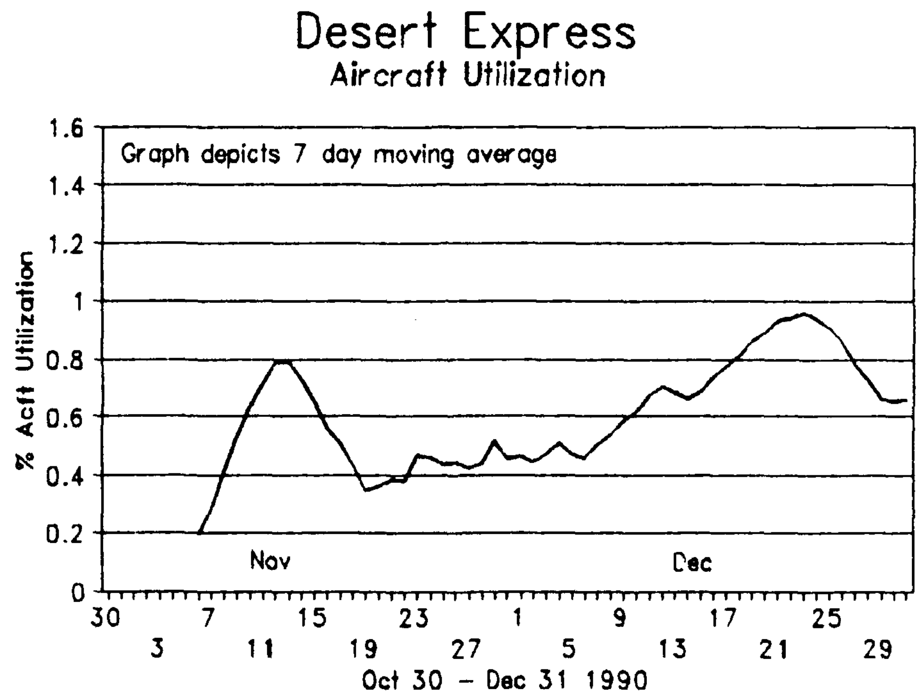

Figure 5. October - December 1990 Utilization (HQ 21 AF)

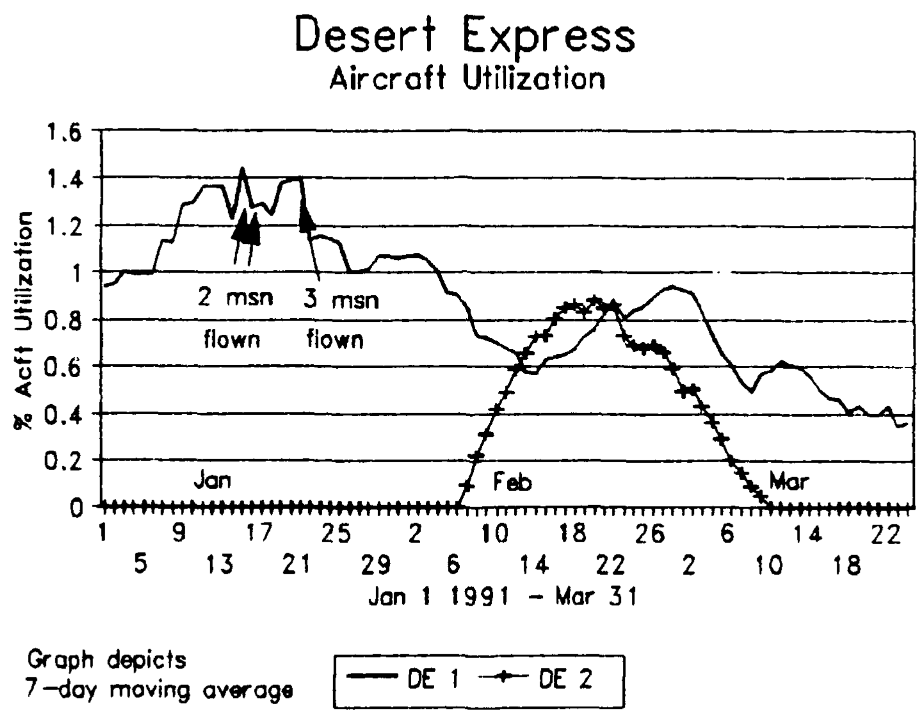

Figure 6. January - March 1991 Aircraft Utilization (HQ 21 AF)

7 November, Dhahran serviced all U.S. military locations in Saudi Arabia for Desert Express cargo. For the routine channels established for Saudi Arabia, MAC used both Dhahran and Riyadh, which improved intra-theater cargo transportation efficiency and limited extra transshipment (HQ MAC/CAT, 170146Z msg, 17 October 1991). Desert Express followed suit.

<u>Project Code 9AU</u>. After the initial system "learning curve", it became apparent that the established project code for Desert Shield cargo (9BU) would be inappropriate for designating "show stopper" cargo moving on Desert Express. The problem of moving 999/MICAP cargo through Dover and Tinker AFBs remained; Desert Express was one opportunity for the customer to avoid cargo being backlogged at one of these ports. To provide faster handling in the system prior to arriving at Charleston, the Joint Chiefs of Staff authorized the project code 9AU to designate cargo moved on Desert Express (Joint Staff, 072054Z msg, 7 November 1990). Supply activities were also notified of this change; the entire pipeline was aware of the urgency of moving these particular requisitions.

<u>Phase II Deployment</u>

On 8 November 1990, President Bush announced that the U.S. would send an additional 150,000 to 200,000 personnel (with accompanying equipment) to the Gulf region, almost doubling the force deployment. One reason speculated for

the increase: to provide the coalition of allies (which included many Arab nations) with an offensive capability if needed (Church, 1991:48). As Figure 5 depicts, Desert Express usage increased dramatically at this time. However, usage decreased as November progressed.

January 15, 1991 Deadline

The United Nations made history on 29 November 1990 when the Security Council voted 12 to 2 (with China abstaining), approving a resolution that authorized the U.S. and a coalition of allies to use "...'all necessary means' to eject Saddam's (Hussein) forces from Kuwait if he had not pulled them out by the resolution's deadline, January 15, 1991" (Woodward, 1991:334). Desert Express utilization began a steady increase through December (Figure 5) and into January, 1991 (Figure 6). The peak usage for the mission coincided with the beginning of the air campaign on 16 January 1991. Figure 6 shows that aircraft utilization exceeded 100% in January. The statistic is based on 100% utilization being a 36,000 pound standard aircraft cargo load.

Coinciding with the date of the United Nations resolution (29 November 1990), USTRANSCOM changed the aircraft pallet position allocations. The new allocations were: Army- six, Air Force- five, and Navy/Marines one (shared) (USCINCSTRANS/TCJ3/J4, 291340Z msg, 29 November 1990). This change reflects USTRANSCOM management's constant review of the supported theater commander's situation assessment.

System Policy Changes

On 4 January 1991, a significant system policy change was enacted. Originally, "married" pallets (two cargo pallets coupled and used for oversized cargo longer than one pallet) and cargo requiring a courier were not authorized. Effective 4 January, married pallets and courier material were authorized, but required USTRANSCOM approval prior to clearance by the Shippers' Service Control Office (SSCO).

A second policy change opened all AOR locations where American forces were deployed (including Cairo, Egypt) to Desert Express service. Shippers were responsible for annotating the final destination as the aerial port of debarkation (APOD) on shipment paperwork (HQ AFLC/DSTL 041645Z msg, 4 January 1991, USCINCTRANS/TC-J3-J4 041755Z msg, 4 January 1991).

Desert Express Use Grows

By 10 January 1991, the amount of Air Force "show stopper" cargo, to move on Desert Express, increased to the point that a larger aircraft allocation was needed. One justification for the increase was the amount of cargo to be moved. For example, the allocations for missions scheduled to depart Charleston on 10 and 11 January 1991, were cleared (by the SSCO) by 7:30 A.M. on 9 January 1991. The SSCO estimated that 4100 pounds of Desert Express cargo were diverted to regular Desert Shield cargo channels. Figure 7 illustrates the number of pounds of 9AU shipments diverted between 27 January and 19 February 1991.

A corollary reason for increased Desert Express use involved the shippers' sense of urgency to get "show stopper" requisitions to the AOR prior to 15 January 1991--the deadline established by the United Nations Security Council resolution (HQ AFLC/DST 101506Z msg, 10 January 1991).

MAC's response to AFLC's request was adding additional airframes on three different occasions: 13 January 1991, two missions flew; 15 January 1991, two missions flew; and 21 January, three missions flew (see Figure 6).

Allocation Increase. USTRANSCOM managers determined a need for adjusting aircraft allocation for the service components. The new allocations were:

> Army: 16,500 lbs (5.5 pallet positions)
> Air Force: 13,500 lbs (4.5 pallet positions)
> Navy: 4500 lbs (1.5 pallet positions)
> Marine Corp: 1500 lb (.5 pallet positions)(USCINCTRANS/CAT, 130328Z msg, 13 January, 1991).

Customer Use Continued Increase

Figures 8 and 9 depict Desert Express utilization for the Air Force and the Army during January -March 1991. Figure 9 reflects the additional mission, which handled predominantly Army cargo

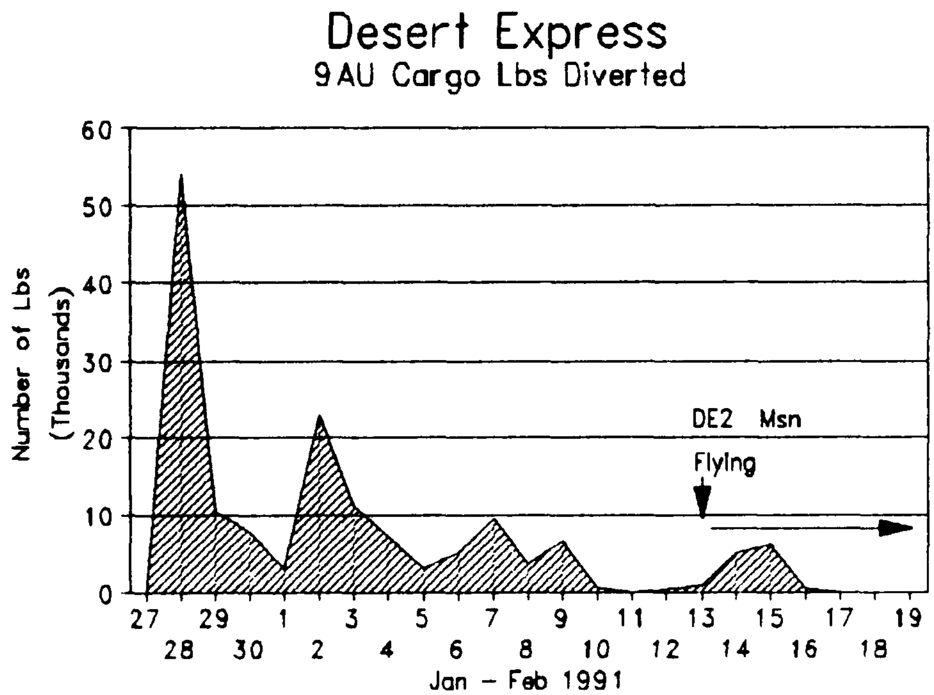

Figure 7. 9AU Shipments (lbs) diverted (HQ AFLC)

Business increased to a point that on 13 February 1991, a second flight was initiated 13 February. The second mission flew for one month. After 13 March, one mission handled cargo requirements. By that time, the cease-fire was in affect.

Conclusion

Desert Express represents a significant change in MAC operating philosophy. Regular channel missions operate frequency basis, operating on set schedules. MAC currently has two mission series designed to move high priority shipments-- the 707-708 mission series in Europe and the 807-808 mission series in the Pacific. These missions operate whether the aircraft is full or partially full. If there is additional cargo in the MAC airlift system or there are predictions of additional cargo in the system, airlift schedulers will plan more airlift for the channels that have the additional cargo requirements. Desert Express represents a frequency channel; the mission flies whether there is a full aircraft load of cargo or just a few shipments (Heatherton: 1990, Mann: 1990). The change was the express package concept specifically designed to fulfill the customers' requirement for rapid, consistent transportation.

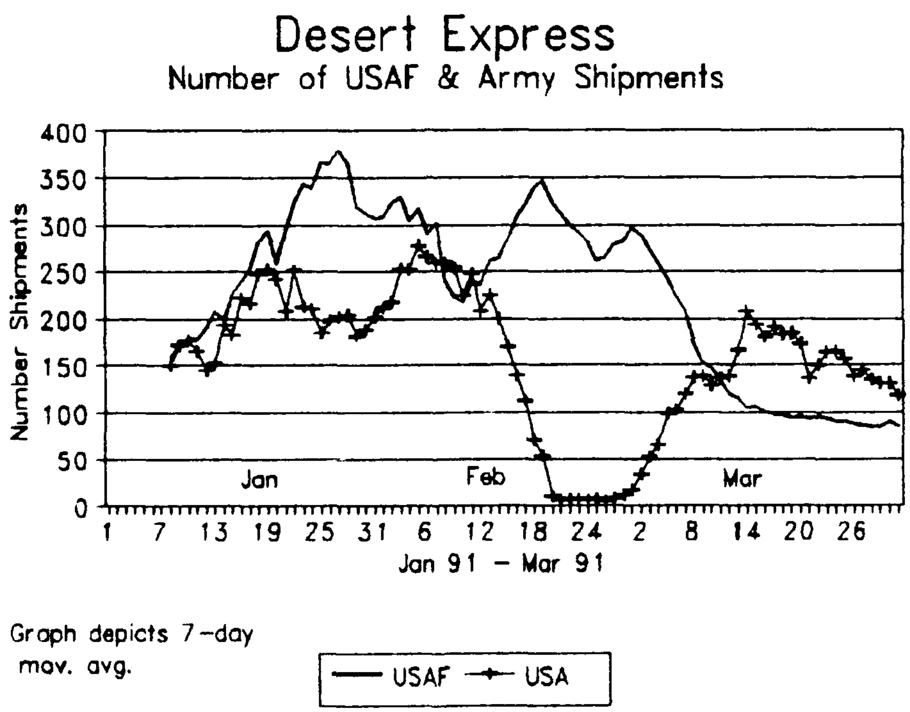

Figure 8. Air Force/Army Utilization Statistics (HQ 21 AF)

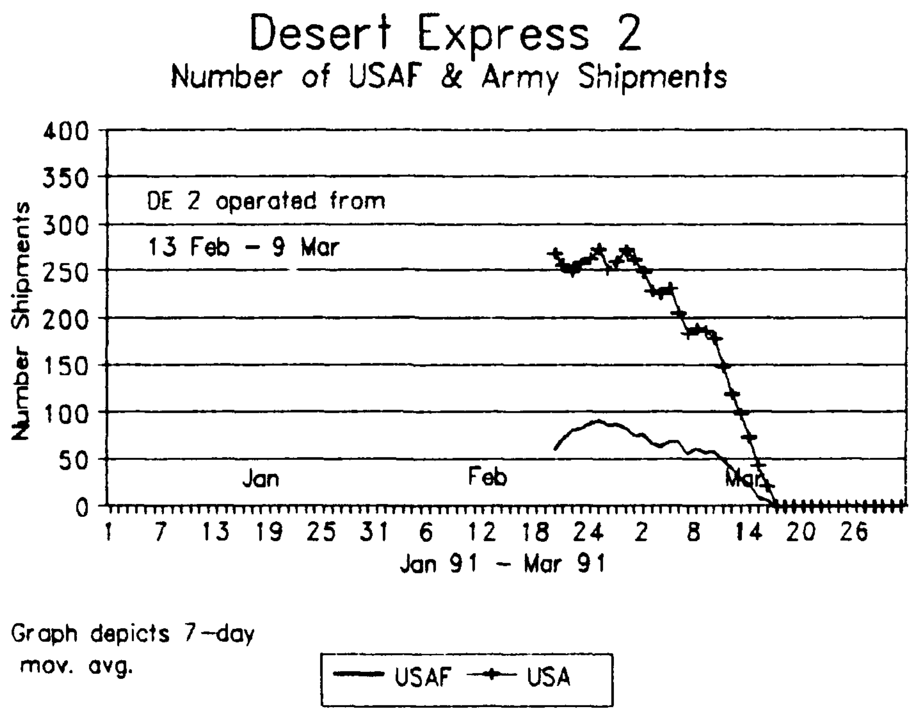

Figure 9. Air Force/Army Utilization Statistics- Desert Express 2 (HQ 21 AF)

V. System Results

Introduction

This chapter examines the entire Desert Express system performance. The focus will look at the system as a pipeline. Interviewees judged effectiveness and efficiency in several categories: cargo clearance, computer challenges, intransit cargo visibility, system effectiveness analysis, and possible performance measures. Customer response provides a qualitative view of the system. Quantitative data, covering the number of shipments moved (daily and aggregate), the number of pounds moved (daily and aggregate), the number of shipments and weight amounts for each service component, the number of cleared shipments, the number of shipments not positively cleared, etc., have been gathered and examined to determine possible measures of merit. The data time frame was from 30 October 1990 to 31 March 1991. The question: which measure best describes the success or lack of success within the system? Other questions considered: 1) Do the data suggest the system was effective? 2) When analyzed, are there areas of difficulty within any of the subparts?

This chapter also will compare the cargo backlog at Charleston AFB, the aerial port of embarkation (APOE) for Desert Express, and Dover and Tinker AFBs and Naval Air Station, Norfolk, Virginia (the three ports that handled channel traffic to the AOR), to ascertain how the airlift system as well as the entire pipeline, adapted to the policy changes of a new transportation service. System process control (SPC) analysis was used to determine if Desert Express (as a transportation system) remained in statistical control. SPC was also applied to the backlogs of the three aerial ports processing 9BU cargo. The intent was to analyze Desert Express against the 9BU cargo movements.

Desert Express success can also be measured in qualitative terms. What is the customer's perception of response? To answer this, Desert Express was examined in a greater context than just a daily mission. Desert Express was a complete sub-section of the overall logistics pipeline; it was also a complete pipeline system.

Desert Express Pipeline

Pipeline initiation began with a forward using organization requiring (as an example) an aircraft nose gear that was not available at the deployed location. Figures 10 and 11 depict the requisition routing. The supply unit, one of the 29 deployed supply accounts, sent a request through the communications network to Central Command-Air Force/ Rear (CENTAF/Rear), Consolidated Supply Support Activity (CSSA), located at HQ TAC, Langley AFB, Virginia (Mann, 1991; Lubinger, 1991; Livermore, 1991; Grove 1991). Within eight hours, the CSSA mainframe computer has identified the source for the required part through either the DL 35 information system (data of parts availability at depot level) or the MICAP Asset Sourcing System (data of parts availability data at base level) and generated the request (Lubinger, 1991; Grove, 1991). The key was urgency. Every person involved placed great emphasis on "pulling" the part, packing it, and completing the supply documentation.

At the base level, the base supply forwarded the shipment to traffic management for final shipment preparation. At the depot or contractor level, the part is given to the transportation function for packing and documentation. During this phase, the package had a special symbol placed on it. This yellow symbol, MAC Form 215, alerted all agencies involved with the shipment that rapid movement of the package to the Desert Express APOE was crucial. The final step was sending the shipment to the Desert Express APOE via expedited transportation (military or commercial). The goal: have the requisitioned part on the Desert Express aircraft by the day after requisition receipt at the part source. Figures 12 and 13 indicate the overall dominant mode of transportation between the shipper and the APOE was commercial air express. Air Force shippers used the Air Force contracted Logistics Air service (LOGAIR), Navy contracted Quick Transportation air service (QUICKTRANS), or surface motor carrier (commercial or military) if the cargo could move from the shipping installation to Charleston AFB before 10:30 A.M. the next day. Bases primarily in the Southeast U.S. could use

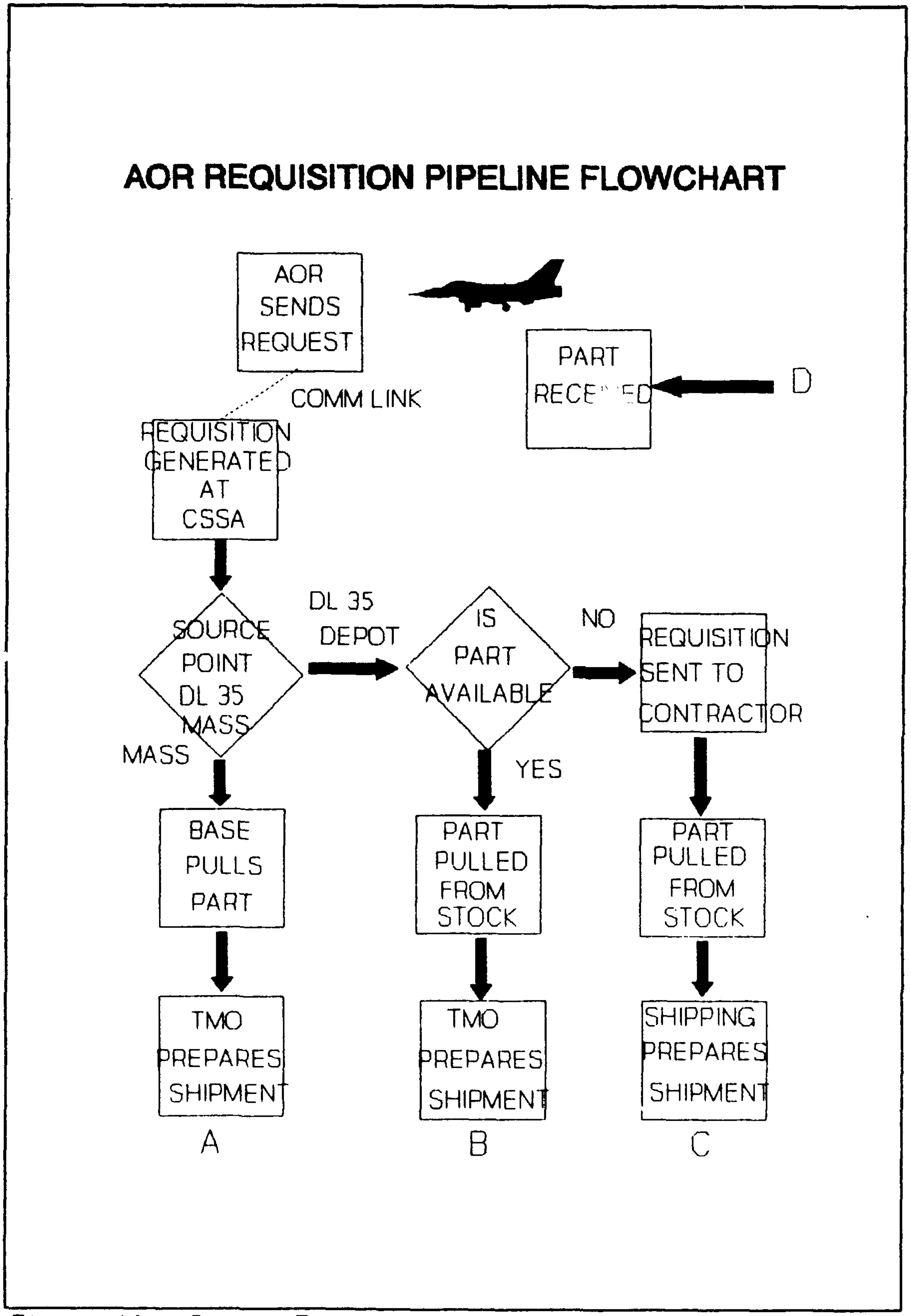

Figure 10. Desert Express Pipeline

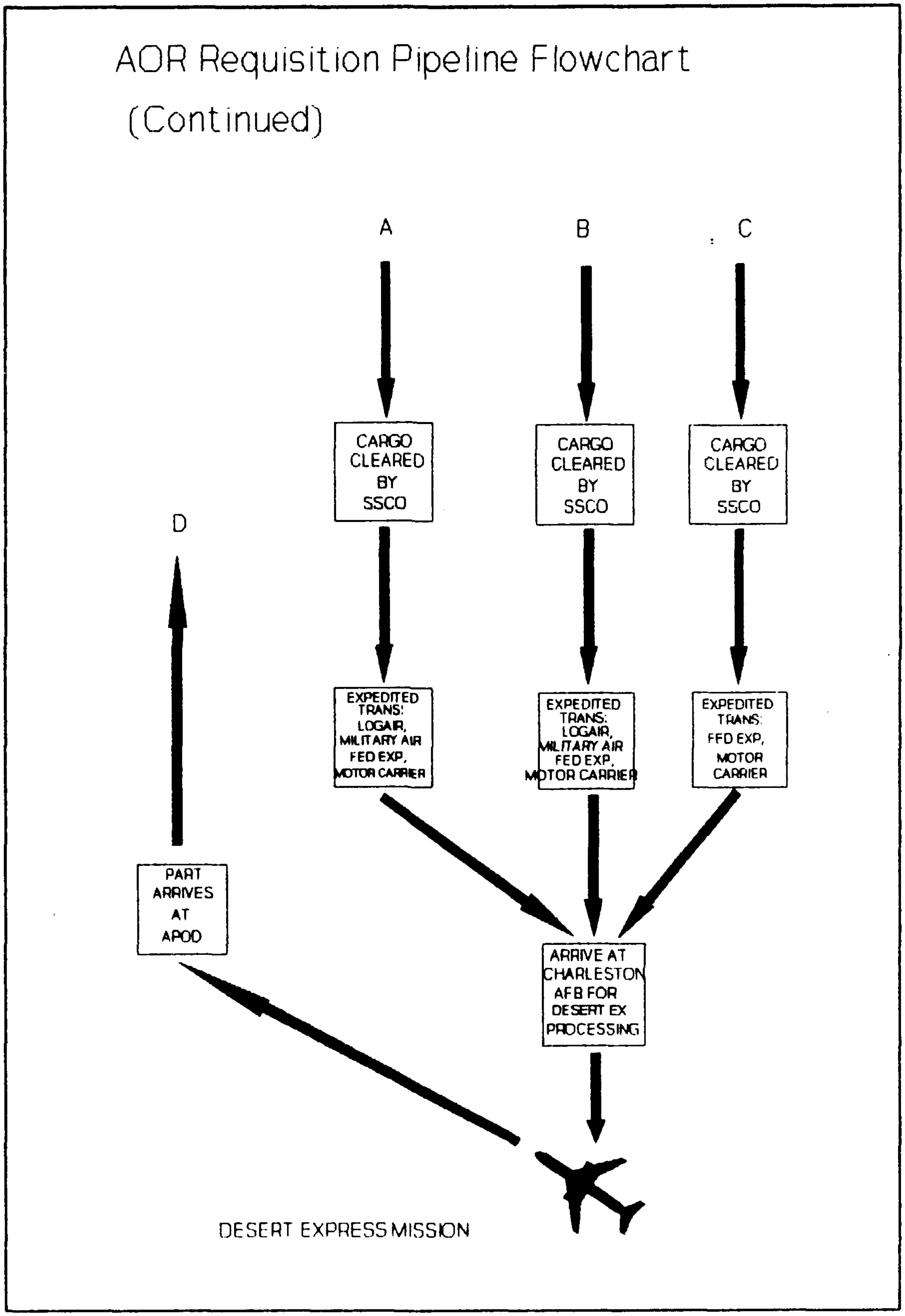

Figure 11. Desert Express Pipeline (Continued)

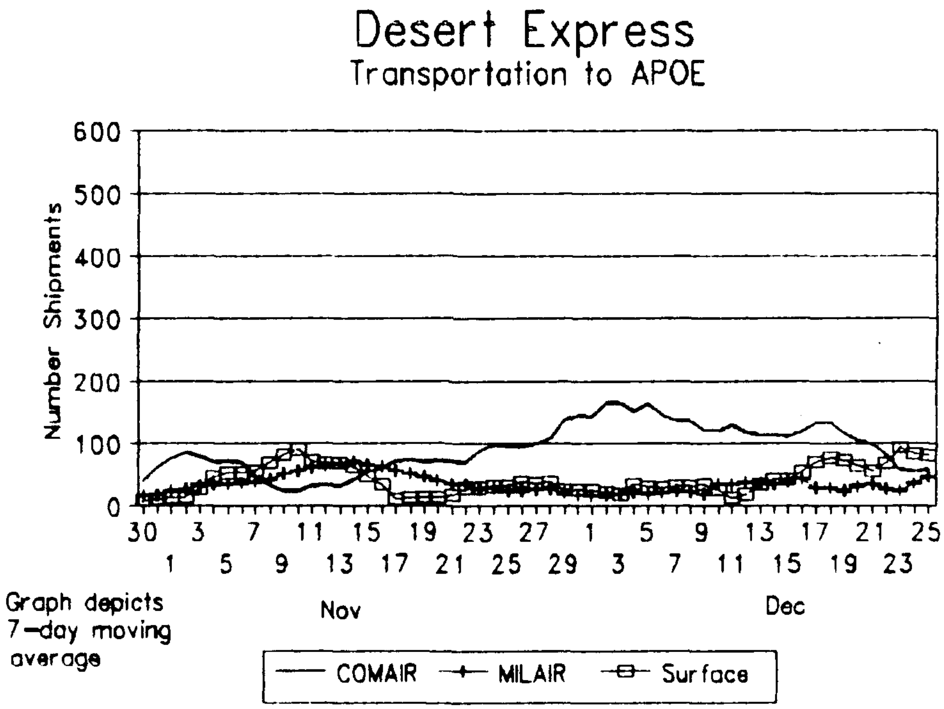

Figure 12. Intra-CONUS Transportation Comparison (HQ 21 AF)

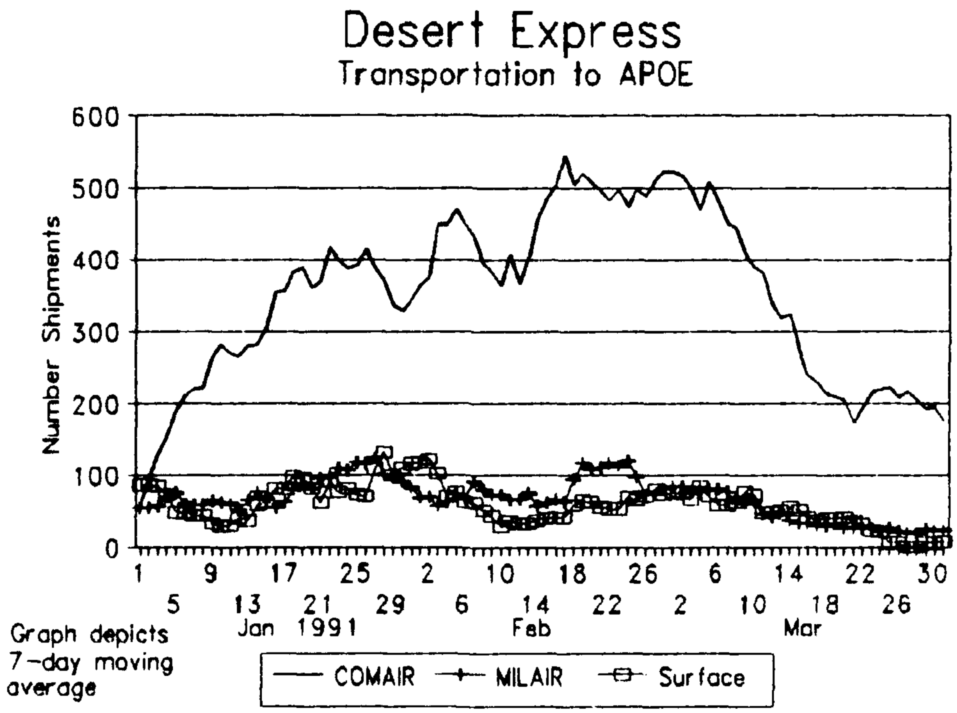

Figure 13. Intra-CONUS Transportation Comparison (HQ 21 AF)

military organic or contract transportation (such as LOGAIR) and meet the deadline.

As discussed, Desert Express planners assumed that primary transportation from bases/depots to Charleston AFB would be commercial air express. However, Figure 12 also indicates that in the early days of the Desert Express mission, the dominant mode of intra-CONUS transportation was surface (which included commercial motor carrier and organic vehicle assets). The next mode of choice was military air (LOGAIR and QUICKTRANS). It was not until after 17 November 1990 that the commercial air express became the primary mode to the APOE. The lack of DoD funding for Desert Shield support to base level organizations fostered early hesitation to using commercial air express (Mann, 1991). Across the Air Force, base level operation and maintenance (O&M) funding was already stretched to maintain normal base operations. Even though Desert Shield was preparation for defense of possible hostile action, Air Force shippers appeared reluctant to use commercial air express to move "show stopper" parts and supplies to Charleston. The resolution of the fiscal question generated a dramatic increase in shipments moving via commercial air express.

Once at the Charleston aerial port, it was a team effort between air transportation, operations, and aircraft maintenance to insure the mission launched on time (Reeves, 1991; Morley, 1991). Morale was high as individuals, involved with system execution, contributed to the successful support Desert Shield/Storm.

Once the Desert Express mission arrived at the aerial port of debarkation (APOD) in Saudi Arabia, aerial port personnel sorted the shipments for final destinations within the theater. The two primary forms of intra-theater transportation were surface motor carrier (including "Blue Ball Express") or the "Camel Express," intra-theater C-130 aircraft (Sledge, 1991; Morley, 1991).

Transportation time for a requisition from Charleston AFB to the AOR was as low as 16 hours and 15 minutes. Total pipeline time was as low as 31 hours (less than 1 and 1/2 days) from the time of requisition until the consignee receives the part (Fulghum, 1990:20). The CSSA set a 48 hour delivery time (from requisition to acknowledgment of receipt) as a pipeline performance measure (Lubinger, 1991). This standard assumes there are no constraints anywhere in the entire pipeline. The average time for pipeline response, using Desert Express, was 11 days, indicating there were areas of constraint in the pipeline. Response time could have been improved. Eliminating or limiting constraints (as the time required for an item manager to approve an item release from the depot), will improve overall performance (Grove, 1991).

Unbridled use of TP-1 (999) inundated aerial ports having resupply channel missions to the Gulf, with more cargo than airlift to move it. The Consolidated Supply

Support Activity (CSSA) generated the requisitions for the satellite supply accounts in the AOR. The accounts were connected to the CSSA mainframe (Grove, 1991). CSSA provided one control on establishing the proper supply priority and transportation priority for each requisition. Subsequently, this provided some control over the amount of cargo moving on Desert Express by "checking" the priority assigned to each shipment. With Desert Express, system planners promulgated guidance to further control the amount of cargo accepted for the mission.

Positive Cargo Clearance

In providing initial deployment or resupply logistics support to forward combat units, the strategy has been (and is): upon receiving a requisition, the source organization (base, depot, or contractor) quickly procures the needed item(s) and completes the supply documentation. The documentation contains the supply priority that determines the transportation priority. The base Traffic Management Officer sends the required supplies and equipment to the APOE or sea port of embarkation by the most effective mode. Each base sent equipment and supplies to the established ports of debarkation as requisitions were levied. Contractors sending requisitioned items directly to Desert Express, were not familiar with the positive clearance requirement; traffic managers sent shipments as soon as possible. This "free flow" of cargo built large backlogs at aerial ports or seaports if there were inadequate vehicles to move the cargo.

Competition for Airlift. In an era of force response to low intensity conflict, a planning challenge remains: two force deployment phases (force movement and resupply) occurring simultaneously and competing for the constrained resource-- airlift. Desert Shield encountered this problem (Waggoner, 1991). Depending on the size of the force deployed and the amount of time to complete deployment phases, cargo for supporting deployed units can wait at the aerial port until airlift (being used for deployment) becomes available. During the Desert Shield/Desert Storm operations, the growing backlog situation (at all aerial ports) indicated an insufficient amount of airlift to move resupply cargo was evident (Figure 14). During the initial force deployment, MAC adjusted airlift scheduling to provide the airlift for rapid force movement. MAC was flying a total of 300 Desert Shield missions per day during the initial deployment. CINCMAC also activated the Civil Reserve Air Fleet (CRAF), stage 1, to assist in the lift. By November, the mission count dropped to 150 missions per day. When the Phase II deployment began, MAC surged to 400 missions per day (Morley, 1991). The change from deployment mode to resupply mode and back to deployment mode could explain the broad variation in 9BU (JCS project code for Desert Shield/Storm) cargo backlogs, especially at Dover AFB.

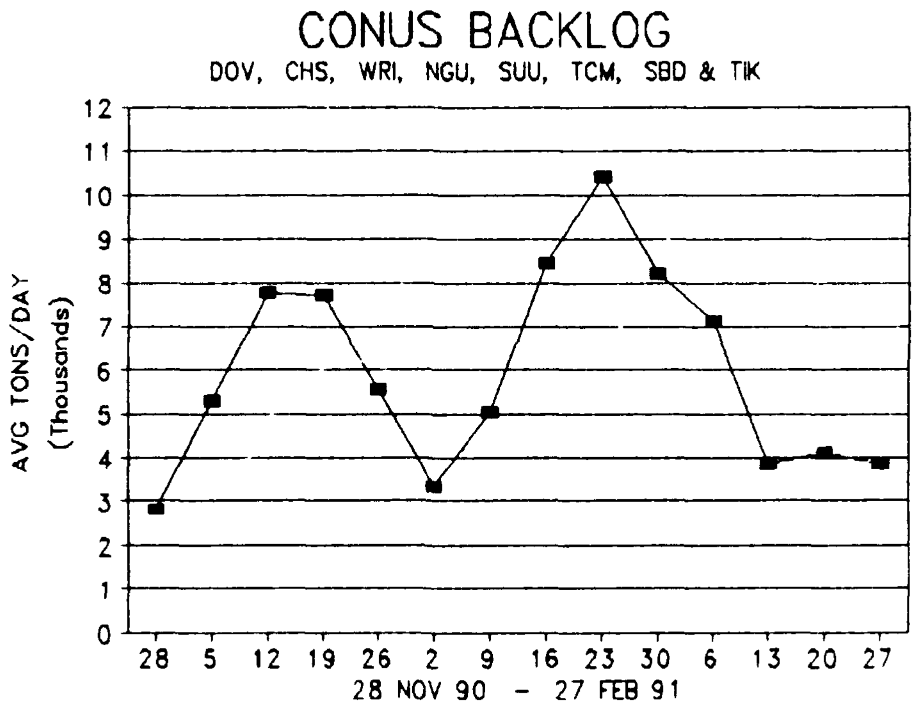

Figure 14. CONUS Cargo Backlog (HQ AFLC)

The new policy, requiring positive clearance by the SSCO before a shipment could be sent to Charleston AFB for Desert Express, was sound in theory. The intent was to match cargo loads to available airframes and avoid a cargo backlog at Charleston. As Figure 15 indicates, the theory was generally successful in the beginning, however as familiarity with the system increased, cargo amounts exceeded movement capability. Even with the backlogs, the positive clearance was instrumental in maintaining the cargo backlog at manageable levels. Eventually, as the backlog went up in January, some 9AU (JCS project code for Desert Express) shipments were diverted to other ports (Mann, 1991, Sledge, 1991). There were problems associated with the clearance process. The SSCO has an automated system for providing positive control and positive clearance for all CONUS generated Air Force air eligible cargo-- the Enhanced Transportation Data System (ETADS). In a peace time environment, after shipments are cleared for air movement, data is batch fed into the ETADS system-- a process that could take up to four hours (Mann, 1991). The data, for MAC airlift shipments, is sent over the automated digital network (AUTODIN) to HQ MAC data base. ETADS also automatically dispatched a challenge message to a shipper if a shipment did not meet MILSTAMP eligibility for air movement. With the increase in 9BU cargo movement, ETADS could not process 9AU shipment data to meet the "next day" delivery criterion to Charleston AFB. To fulfill the

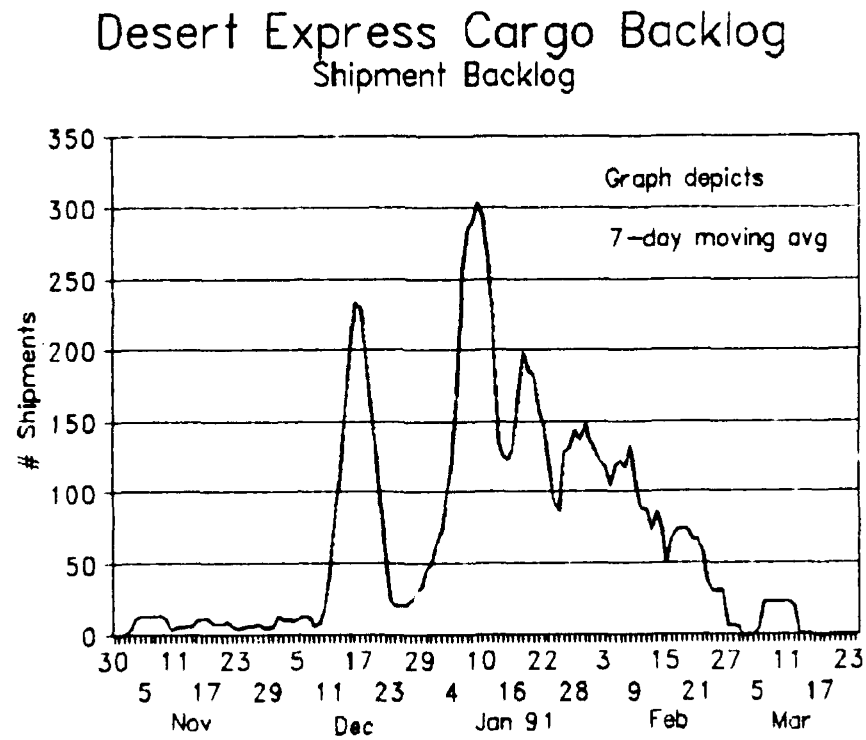

Figure 15. 9AU Cargo Backlog (HQ 21 AF)

shortened timespan to clear 9AU shipments and to meet the increasing customer demand for Desert Express service, SSCO used a manual system for clearing the cargo. This system consisted of telephone communication with customers and facsimile communication with aerial port personnel at Charleston AFB.

Cargo Clearance Difficulties

Problems developed for the Desert Express system through the requirement for positive clearance for all Desert Express cargo. During the planning for Desert Express, the decision was made to limit the inflow of cargo only to those items cleared through the Shippers' Service Control Office (SSCO). MAC and AFLC agreed with this USTRANSCOM policy, while at least one customer felt that the free-flow of cargo into the Desert Express APOE was more beneficial (Livermore, 1991). The SSCO used a manual clearing system. The automated portion of ETADS could not handle the increased workload and provide clearances or shipment mode challenges (as applicable) and allow 999 or MICAP cargo to meet the customer's requirement. The clearance process provided difficulties for customers as phones to the SSCO were often busy (Mann, 1991; Livermore, 1991).

The number of shipments arriving at Charleston without clearance was a significant problem (Figures 16 and 17). It was most acute in December and January when cargo inflow greatly increased. During February and March, the number of non-cleared shipments decreased as total amounts decreased.

The shipping customer perceived difficulty with the process of clearing shipments; the procedures require upgrading (Waggoner, 1991). This perception provided incentive to move cargo before receiving clearance in order to save time. It also contributed to the Desert Express backlog.

Another situation related to shipment clearance developed; the advance transportation control and movement Document (ATCMD) data did not come to the SSCO in the MILSTAMP time criteria. This created a "no-hit" situation (Mann, 1991). MILSTAMP requires the shipper to have this data to the SSCO two hours prior to tendering a shipment to a carrier for movement to the MAC APOE (DoD 4500.32R, 1987:2-B-34). The MILSTAMP procedures for tendering shipments still applied to 9AU shipments as well as 9BU shipments to the AOR. The SSCO not having the advance data resulted in Charleston aerial port personnel not having advance data notification of an enroute shipment. The MAC database would not show the shipment; by definition, a "no-hit". With the number of shipments processed each day (especially during the peak periods), a "no-hit" shipment would have to be delayed until the shipment information was input into the MAC database. Hardware limitations apparently increased the number of "no-hit" shipments.

Advanced shipment transportation data (on 999

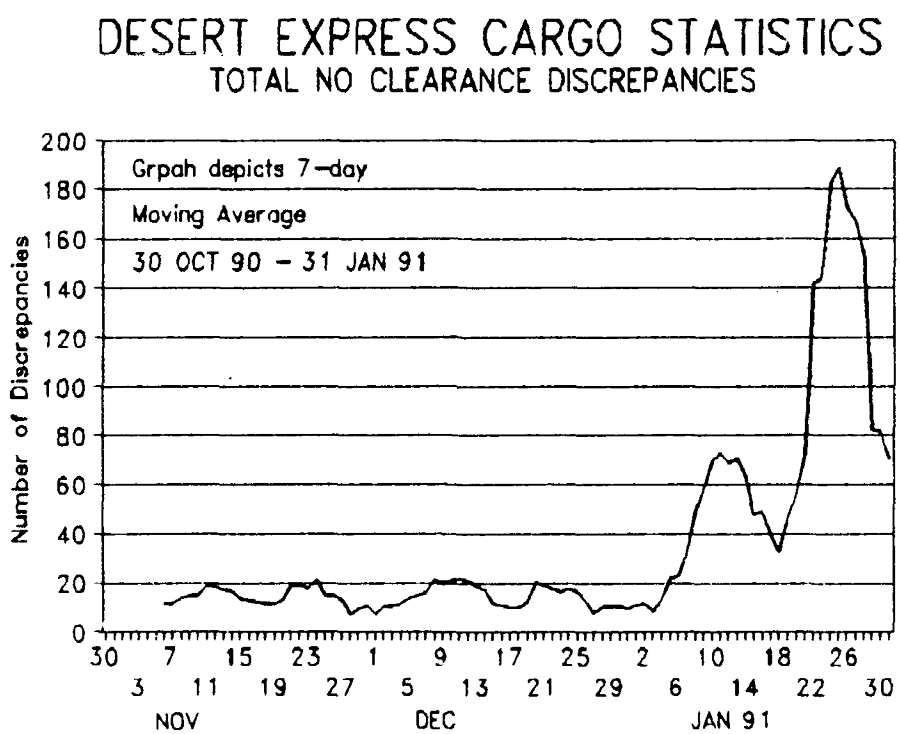

Figure 16. Desert Express Shipments Not Cleared (HQ 21 AF)

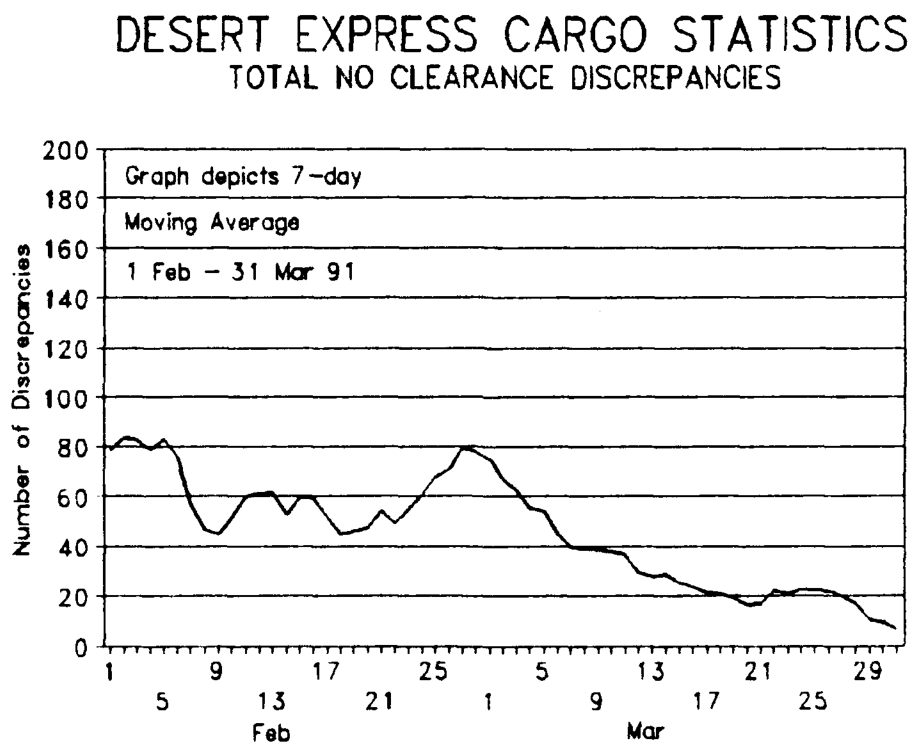

Figure 17. Statistics for Cargo Not Cleared (HQ 21 AF)

shipments) was required two hours prior to clearing the shipment through the SSCO (DoDR 4500.32R, 1987:2-B-30). The information was placed in ETADS and eventually transferred to ADAM III. The Charleston aerial port was aware of the shipment (through the nightly information transfer from the SSCO), but when the shipment arrived, port cargo personnel could not find the ATCMD information in the ADAM III system (Eddy, 1991). The shipment information is the key element in preparing the automated aircraft manifest. The Military Air Terminal Coordination Unit (MATCU) at Charleston provided a critical service by finding the information on shipments with minimum shipment delay (Elam, 1991).

The problems of shipments without positive clearance and/or "no-hit" can best be solved through educating the shipper on MILSTAMP procedures. Renewed emphasis on having one process for preparing shipments for transportation, in contingency and peacetime is critical (Waggoner, 1991).

Changes on shipment preparation are necessary and will improve operations. Another area requiring improvement is cargo visibility at any point within the pipeline. For customers, visibility in the transportation mode is most important. System operators provided a method that greatly improved intransit visibility.

Intransit Visibility

The problem of intransit visibility was not limited to Desert Express; it occurred during the entire Desert

Shield/Storm operation. For example, when a deployed supply organization issued a part, supply would also request a replacement part from CONUS. If that part was "lost" in the system and did not arrive at the AOR within a reasonable period of time, an additional requisition would be sent, creating potential "visibility" difficulties. There were instances when the same requisition inadvertently received two different transportation control numbers (TCNs). If tracing action was required for a shipment that had two TCNs, researchers may not find the shipment under the one TCN and assume the shipment was lost, canceled, or delivered. The same shipment was in the system, but "hidden" since it is moving under a different TCN. Such situations served to increase the workload throughout the pipeline, to increase pipeline response time, and to increase the customer's frustration level.

One principal customer criticism of Desert Express was intransit cargo visibility. Once a shipment was placed in the Desert Express system, the originating shipper would not know that the shipment had reached its final destination until the receiving supply unit had notified the CSSA (through the Standard Base Supply System- SBSS) that the shipment had officially been received. If a shipment was lost in transit, it was more difficult to trace its whereabouts. This difficulty stems in part from the current system of one transportation database for air movement of shipments (MAC ADAM III) communicating with the Air Force shipment clearance database (ETADS). While the two databases could exchange information, the communication system involved batch processing (a lengthy process) and sending the information over the AUTODIN network (Mann, 1991). In the terms of information flow from (for example) MAC to AFLC, data received over AUTODIN was placed on a tape system. The tape was physically retrieved from the communications center and placed on a "reader" in the ETADS hardware. Data updates would then be placed in the ETADS database. The system could not provide real time information (Mann, 1990).

During Desert Shield/Storm (using ADAM III and ETADS as examples), both critical transportation data systems became saturated. Information retrieval (for tracing purposes), was drastically slowed. ETADS is designed to perform several auditing functions (for example: billing customers and sending computer-generated "challenge" messages to shippers concerning cargo that should not have been submitted for air shipment). Each of these program functions requires hardware capacity and causes the program and the hardware to operate more slowly (Holevar, 1991). Accessing information from either database was extremely difficult, let alone extracting information to conduct tracing actions.

AFLIF. HQ AFLC required a method to provide the customer with more accurate as well as real time tracing information. By November, the problem was acute and required a proactive solution. The answer was the Air Force Logistics Information File (AFLIF). It required five weeks and approximately 3000 lines of computer code to build the program and make it functional (Associated Press, 1991:24). The computer system to operate the prototype program was excess hardware from another computer operation, therefore costs were minimal. Program coding required only two personnel (Holevar, 1991). By 20 December 1990, AFLIF was able to "capture" MILSTAMP data from the transportation system. By 26 December, AFLIF was able to "capture" supply status (Military Standard Requisitioning Procedures-MILSTRIP) data (Holevar, 1991b:1). On 10 January 1991, the new system came on line.

System Design. The object of AFLIF was to combine order status information from the supply data system and mode/location information from the defense transportation system into a single display with all of the applicable information. AFLIF provided this capability.

The transportation data was readily accessible through the ETADS database. AFLIF was connected to the ETADS system. For cargo accepted in the airlift system, MAC had records in ADAM III. Every three hours, MAC updated the ETADS data; eventually this time was reduced to a half hour (Sledge, 1991). For Air Force cargo accepted in the sealift system, Military Sealift Command (MSC) provided the SSCO information updates, also placed in the ETADS database. The only "blind" area was retrieving information from the supply system. The answer was found in accessing the electronic supply documentation between the satellite supply accounts, supporting the Air Force Desert Shield units, and supply agencies in the CONUS. Any electronic transmission automatically advances through the Defense Automated Addressing Systems Office (DAASO) in either Tracy, California or Dayton, Ohio. Programmers coded the AFLIF program to "read bulletin boards" at both DAASOs every 15 minutes and extract supply status information (Holevar, 1991; Holevar, 1991b:1). The result: current data for each shipment based on each update, virtually a real time system.

The AFLIF system was built on the pipeline principles previously discussed. Figure 18 depicts the interface of AFLIF with the entire pipeline. The figure shows the three different requisitioner and the supplier communications required in the process of ordering and receiving a part or supply item (Holevar, 1991). When the transmission transits the DAASO, the address is read. Addresses of the 29 satellite supply accounts were "flagged" and a copy of the message information would be placed on a DAASO computer bulletin board that was read by the AFLIF computer. The first communication is the requisition order. As indicated in the flowchart, the electronic transmission goes through the DAASO when the order is sent. When AFLIF reads the DAASO bulletin board, it "notes" the requisition and records the information in its database. The second communication comes from the supplier to the requisitioner stating that

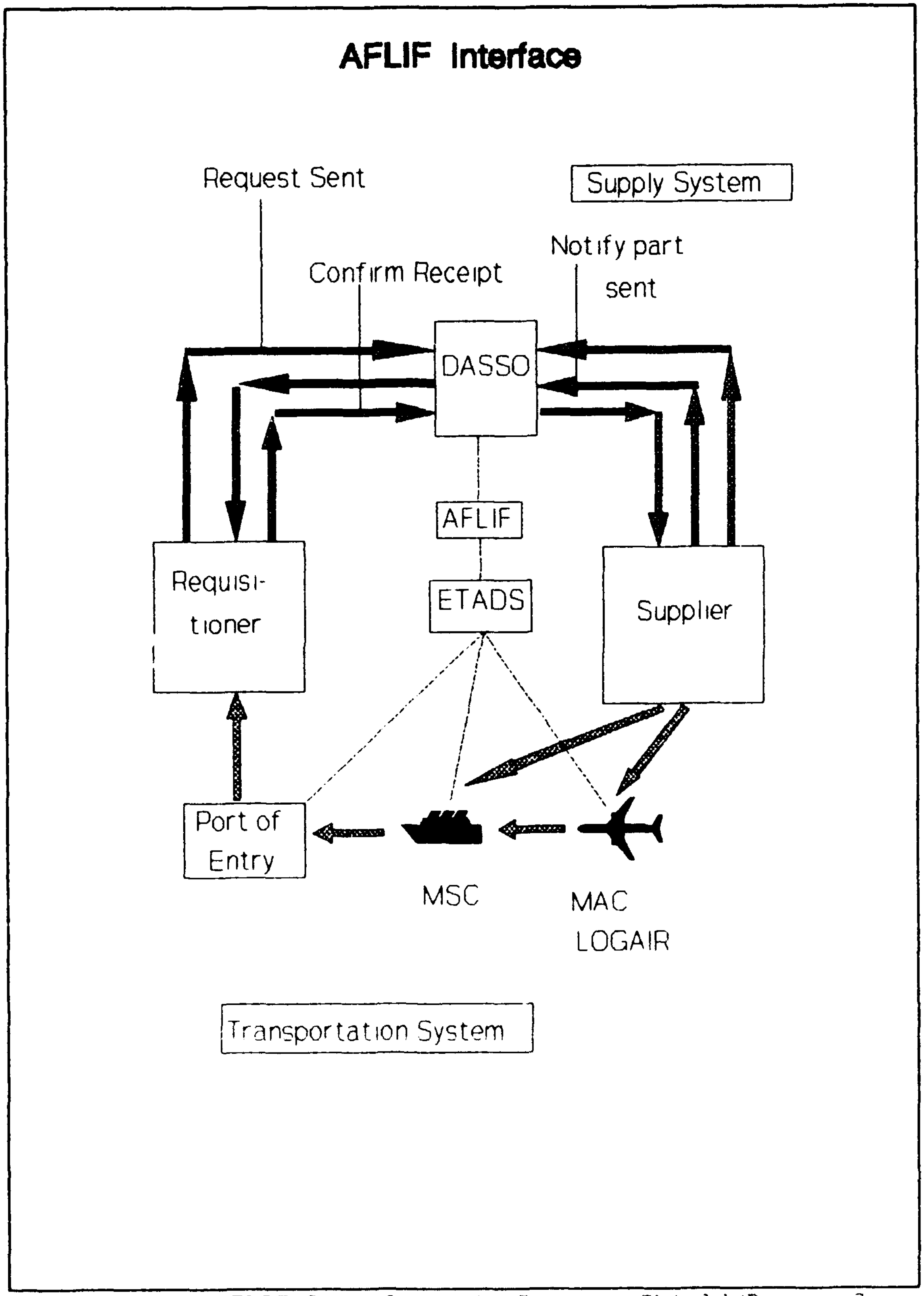

Figure 18. AFLIF Interface in Desert Shield/Desert Storm Pipeline

the part has been sent (for simplicity, assuming the part is available at the supply location). Once again, when the communication goes through DAASO, it is placed on the bulletin board for the AFLIF computer to read. The final line of communication, within the supply system, is the confirmation of receipt of the order by the requisitioner. Once again, the electronic transmission goes through DAASO and the relevant information placed on the computer bulletin board for the AFLIF system to read. This process provided the visibility of an order while it is in the supply chain.

Modal Visibility. Information accessibility, while a requisition is in the transportation system, was relatively simple. The AFLIF system accessed the "raw data" from ETADS and placed it in the AFLIF database. It was (and is) very important to retrieve the raw data from ETADS before it was processed in any of the sub-programs within ETADS (Holevar, 1991). The problem using "processed" data is the time involved retrieving information once it is processed. As Figure 18 indicates, transportation updates from MAC and MSC are placed in ETADS. AFLIF periodically "reads" the database and adds all information updates.

When an Air Force shipment goes through an aerial port of embarkation (APOE) or sea port of embarkation (SPOE), the MAC or MSC system notes the status change, which is updated in ETADS. Information on further transportation to the final consignee can be retrieved if a shipment is moved on military air or surface transportation. If a commercial carrier provides intratheater service from the APOE to the final consignee, that movement information is not readily available to ETADS and subsequently not readily available to AFLIF. The commercial transportation industry is modifying shipment identification numbers to a system similar to the MILSTAMP format. As this progresses, it will become possible for AFLIF to retrieve the information on a shipment while in the charge of a commercial carrier (Holevar, 1991).

Full Visibility. With information consolidated from both the supply and transportation databases, a customer with a personal computer, modem, and access to the Defense Data Network, can trace a shipment virtually from origin to destination from anywhere in the world. With AFLIF, a "show stopper" item, for Desert Express, could be traced from the time the requisition goes into the supplier until the shipment is received by the end user. One screen of information provides: "...requisition information, supply status, shipment status, MAC and Military Sealift Command movement (receipt and lift), and customer receipt acknowledgment." (Sutterlin, 1991:6). The system requires some knowledge in transportation and supply codes (for example: a transportation control number or a supply code indicating a part is back-ordered if not available). The system also provides menus that interpret the various codes appearing on the computer terminal screen. Information queries are generated by using a shipment's national stock number, transportation control number, or requisition number

(Holevar, 1991b:briefing slide c). One other important feature is the flexibility to identify and trace a shipment within the pipeline that may require diversion to another unit with a greater need for that shipment (Holevar, 1991b:briefing slide d). The vital question concerning the system: how would the customer receive it?

Customer Reaction. The AFLIF system came on line on 10 January 1991; HQ AFLC opened seven accounts. After demonstrations to other prospective Air Force customers, more accounts were opened: CENTAF/Rear and CENTAF/Forward came on line on 15 January 1991 (5 accounts), HQ SAC/LGTT on 18 January 1991 (1 account), HQ USAFE on 18 January 1991 (5 accounts), and the five Air Logistics Centers (with 5 accounts at each center) on 22 January 1991 (Holevar, 1991b:briefing slide d). Reaction was, and is, positive.

The capability to trace a shipment through the entire pipeline is a significant step in improving customer service. Transportation personnel were assigned to CENTAF/Rear's Consolidated Supply Support Activity (CSSA) to manage tracing actions. At the height of the Desert Shield/Storm activity, CSSA personnel numbered 117 (Livermore, 1991). This indicates the labor intensive situation that supply requisitions and tracing actions generated. Tracing actions alone, generated numerous phone calls or messages to each of the "players" involved in moving a shipment from origin to destination. Having access to the AFLIF system from the CSSA greatly reduced the number and length of telephonic and message communications required to locate an errant shipment. Captain Ann Farmer, in an article on AFLIF, quoted Colonel Ronald Waggoner, director of transportation for TAC, on how AFLIF has improved CENTAF/Rear's operation:

> This prototype has tremendously increased our ability to track MICAPs and other items deemed to be show stoppers from the front line in Saudi Arabia (Farmer, 1991:12).

AFLIF has provided an opportunity to increase efficiency and effectiveness of the combat supply pipeline and conserve scarce transportation resources. Customer interest usage has significantly increased. In an interview with Mr. Greg Holevar, HQ AFLC/LGTT, the AFLIF system was demonstrated. The number of customers using the system at that particular time indicates the customer confidence in the system's accuracy. The system prototype was used only for Desert Shield/Storm. Since the Gulf operation, the system has expanded Air Force wide with over 300 active accounts (Reed, 1991).

The challenges and solutions examined also allude to a long-term challenge: cargo processing in the peacetime environment and the wartime environment.

Cargo Processing- Peacetime Versus Contingency

From the customer perspective, there was new evidence of a problem that has existed for quite awhile: two distinct processes for documenting shipments-- one for routine peacetime shipments and one for deployment supplies and equipment. Desert Shield/Storm experienced simultaneous resupply cargo and unit cargo movements. In some instances, unit cargo was separated from the unit and diverted to one of the APOEs for movement to the AOR. This unit cargo was labeled and contained documentation for mobility movement. The increment number for a mobility shipment is different from the transportation control number; when a separated piece of unit cargo arrived at the aerial port, cargo personnel could not find the piece listed in the database; there was no advance transportation control and movement document (ATCMD). The unit piece had to be delayed (or frustrated) until the destination is determined and new documentation could be completed. There was, and is, a need for a single system that would account for all cargo, whether it is unit mobility equipment or resupply cargo.

Colonel Ronald Waggoner Director of Transportation for Tactical Air Command, expressed the need for a change. He felt that there should be no difference in processing cargo in peacetime or during a contingency. The MILSTAMP procedures are adequate for cargo processing in any situation. The Air Force should move toward using one system to process cargo in any situation (Waggoner, 1991). Unit Line Number procedures should be adapted to MILSTAMP procedures. Change 15 to MILSTAMP provides guidance for combining a mobility shipment's unit line number with the transportation control number. If there is adequate automation for MILSTAMP procedures, visibility procedures can work for force deployments (Sledge, 1990). To obtain economies from improved cargo processing and handling techniques, the data systems must be able to function in contingency surge periods as well as the peace time environment.

Computer Challenges

A major problem in the transportation portion of the pipeline, and one that impacted Desert Express mission effectiveness, was computer systems serving the transportation operating agencies. ETADS, used by the SSCO, was effective for peacetime operations, however, the increased cargo shipments during Desert Shield/Storm saturated limited system and severely limited its effectiveness. Information must be batch-fed into the ETADS database. During Desert Shield/Storm, the time required to process the data on each shipment would not allow data input from the increased number of shipments and allow the cargo to move quickly from the origin to the customer (Mann, 1991). Once the shipment information was placed into ETADS, the data for shipments tendered to the airlift system, was transmitted to the ADAM III computer at Scott.

The ADAM III system was extremely hard pressed to handle the data involved with all of the shipments destined for the AOR. At Charleston, the aerial port computer system hardware would not allow simultaneous cargo processing for

Desert Express and any other mission. During morning hours, before Desert Express mission departure, aerial port cargo processors inchecked 9AU cargo arriving on commercial or military carriers. Cargo processors inspected each shipment and placed data information into the aerial port computer. Many of the shipments had bar-code labels attached, however, the scanners could not extract the data from the bar codes. This required the in-checker to manually input shipment data using digital-radio communicators to the port mainframe computer. The sheer volume of several incheckers processing several hundred shipments literally slowed the mainframe data processing time significantly. Processing time would vary from 15 seconds to 2 minutes per shipment (a shipment consisted of normally one piece). At that rate, it was extremely difficult to process the cargo that has been cleared by the SSCO for a specific mission (Eddy, 1991). Of the four departure delays, all were attributed to computer difficulties (Donovan, 1991).

Possible Performance Measures

Figure 19 depicts the amount of cargo moved on Desert Express. However, the data did not provide the complete picture of Desert Express effectiveness as there is no similar "overnight" express system in Air Force history. The closest activities to Desert Express occurred during the Korea conflict and during the Viet Nam conflict. Korea had the "mule train" and Viet Nam had the "Red Ball"-- both

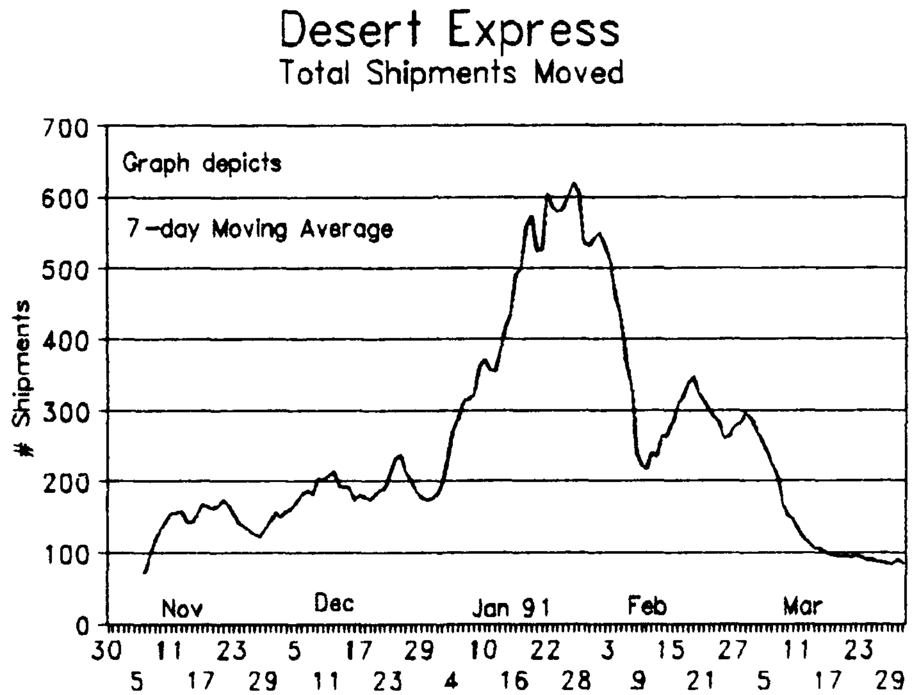

Figure 19. Desert Express Total Shipments (HQ 21 AF)

systems moving priority supplies and equipment from in-theater supply sources to the forward operations (Morely, 1991). Desert Express was the first dedicated mission to fly an "overnight package" express from CONUS to the theater.

First System Effectiveness Analysis

On 14 November 1990, Headquarters AFLC, Transportation Division, released their first Desert System effectiveness report. Between 30 October and 14 November 1990, 69% of the cleared "show stopper" cargo departed on the first available Desert Express aircraft. Eighteen percent of the cargo arrived late at Charleston AFB and had to be placed on the subsequent mission. Thirteen percent of the cargo went out of Dover AFB on Desert Shield channel missions even though the cargo was specifically cleared for Desert Express. Some of this cargo was received in the theater under transportation control numbers (TCNs) that were different from the TCNs cleared for Desert Express for the same cargo (HQ AFLC/DST 141600Z msg, 14 November 1991). There appeared to be significant difficulty in maintaining intransit visibility, especially if individual shipments required tracing.

System Process Control Analysis

When planning and initiating a new process or system, management will require information on different aspects of system performance. For example, is the system operating according to desired specifications? Is the system statistically in control? Is the system providing the quality, time, and place utility that the customer desires? Statistical process control analysis provides a tool to determine if a product or system is providing the quality product or service as that customers desire. (Chase and Aquilano, 1989:180).

Quality Defined. To determine if a system is producing a quality service, a workable definition of quality must be established. Richard B. Chase and Nicholas J. Aquilano define quality in the commercial realm:

> The quality of a product or service may be defined in terms of the quality of its design and the quality of its conformance to that design. Design quality refers to the inherent value of the product in the marketplace, and is thus a strategic decision for the firm...Conformance quality refers to the degree to which the product or service design specifications are met. It too has strategic implications, but the execution of the activities involved in achieving conformance are of a tactical day-to-day nature (Chase and Aquilano, 1989:166 & 168).

It appears to be less difficult to apply specifications to a manufactured product than to a service. A manufactured product is a tangible item that meets or exceeds a series of specifications. Customers purchase a product because that product will perform to expectations for that product. A service, while not an object one can physically hold, also meets specifications measured in different units than manufactured goods. For example, a spring may have tolerance specifications in hundredths of an inch. For a service, the specification may be measured in time units or number of items delivered. The emphasis is: in system planning, the specifications must be well defined to determine if system performance is meeting the goals.

For Desert Express, there are different areas that can be measures of system performance, including: on-time departure and arrival, number of cleared shipments per mission moving on the same mission, number of pounds moved per mission, number of delays in departure, cargo backlog, port hold time, and operational readiness rates of weapon systems in the theater (Livermore, 1991, Waggoner, 1991; West, 1991; Trembly, 1991; Morley, 1991; Elam, 1991). The number of possibilities for measures vary depending on one's viewpoint-- the system operator or the customer. One possible measure to test for system performance is comparing 9AU daily cargo backlog to move on Desert Express with 9BU daily cargo backlog at aerial ports with channels for the AOR (Trempe, 1991).

Using the daily cargo backlog as a system measure is applicable if it measures the Desert Express pipeline as a whole. If the daily backlog were used to measure a system segment, it may not provide an accurate assessment of system performance. In the military airlift arena, the backlog can indicate two possible situations: 1) airlift resources are not available to move the cargo backlog, or 2) given that the inflow of cargo to an aerial port is dynamic, there may an extraordinary large influx of cargo into the aerial port during a given time period. Using the cargo backlog as a measure for segments of the Desert Express system may not provide the accuracy that system managers require for planning or decision making. For example, the backlog does not provide an accurate measure for aerial port operation because port management does not have control over external situations (to the aerial port). Aircraft operations determine if there is available airlift resources to move a cargo backlog at a specific aerial port. Port management does not have control over cargo arrival at the aerial port. Port personnel may be accomplishing and exceeding established work standards; however (using backlog as the measurement tool) if the backlog is large, it appears that the aerial port is not operating effectively. When the cargo backlog is used for measuring total system operation, it can provide the system's senior management with one avenue to determine if the system is statistically in control and capable of providing the service customers expect.

Statistical process control equations were used on random backlog counts for 9AU cargo ("show stoppers" designated for movement on Desert Express) and 9BU cargo (resupply and sustainment cargo moving over established MAC channels to the AOR). The objective for statistical process testing was to determine if the system remained in control or if there were points where the system was out of control.

Such occurrences warrant investigation for the causes. In the case of Desert Express, there were no known established backlog standards; the implicit goal was to have zero cargo backlog at Charleston AFB aerial port after each Desert Express mission departure. Appendix A provides the equations for determining the control limits for the X-bar and R charts (discussed below) for cargo backlogs at Charleston AFB (Desert Express) and cargo backlogs at Dover AFB, Tinker AFB, and NAS Norfolk (channel missions to the AOR). The sample data is also included in the appendix.

X-Bar Chart. The X-bar (or mean) chart plots the mean of the random samples against the grand mean and two statistically calculated control limits. The chart provides a concise view on how a process is performing in relation to the upper and lower control limits-- is the process in statistical control? (Brassard, 1988:51-52; Chase and Aquilano, 1989:181-182). When viewing the chart, any points falling outside either control limit or points forming "...unlikely patterns..." are cause to suspect that the process is out of control (Brassard, 1988:51). Control is defined as consistency of operation. Points that fall outside the control limits indicate a special cause (unplanned events, people error, freak occurrences). These problems must be solved or the system design changed to compensate for such occurrences (Brassard, 1988:52). Patterns of points that fall within the control limits are an outcome of internal variations coming from system design.

An organization has the power or authority to change those elements of the system that cause the fluctuation.

R Chart. The R chart is used in conjunction with the X-bar chart. It depicts the difference (or range) between the highest and lowest number in each sample. The R value can be used in a similar manner as a standard deviation (Chase & Aquilano, 1989:185). The R chart also has upper and lower control limits. If the range goes out of the control limits, there is reason to investigate the cause(s) for variation in the sample.

System Capability. The X-bar and R charts are of little assistance unless they are used with the process capability indices. A system that is in statistical control, but not capable of meeting the customers desires is unproductive. The capability indices allow a manager to determine if the process is within established specifications (Brassard, 1988:64). In the airlift world, different channels generate different cargo amounts and each aerial port has different mission taskings in the contingency plans. This makes it extremely difficult to set a specification for backlog for each aerial port, let alone a general specification applicable to the MAC airlift system (Morley, 1991). Even without specifications for capability analysis, the statistical control analysis indicate some evidence of external causes for extreme variations that requires further inquiry.

Results. Upon examining Dover's 9BU backlog, the system appeared in statistical control until the latter part of November 1990. This time closely correlates to the starting of the Phase II deployment. During Phase II, MAC was flying 400 missions a day to the AOR (Morley, 1991).

The X-bar charts for Tinker AFB and NAS Norfolk (both APOEs for 9BU cargo) reflect similar situations to Dover. The "bulge" of cargo in November built the daily backlog at both Tinker and NAS Norfolk and caused the process to go out of statistical control.

The R chart (range) for Dover's 9BU backlog indicated that the greatest range of difference in the random samples occurred in during December and peaked over the upper control limit in January 1991. This time coincided with the U.N. deadline for Iraqi withdrawal from Kuwait. The R chart for NAS Norfolk depicts the range of differences peaked near the upper control limit in December but remained in statistical control.

For Desert Express, the X-bar chart indicates that the system remained in statistical control. This can be attributed to the use of positive control and positive clearance of cargo before the cargo arrived at Charleston. Except for December, the number of shipments accepted basically matched the aircraft capacity. Another explanation for the process remaining in control after December-- in January 1991, the SSCO started diverting 9AU cargo to Dover or Tinker when the daily allocation for days two and three was cleared early on day one. The strategy was to keep the Desert Express system from being saturated. This was successful, but created some customer dissatisfaction (Waggoner, 1991). Figures 20 - 27 depict the X-bar and R charts for Dover, Tinker, and Charleston AFBs and NAS Norfolk.

Customer Response

From the Air Force customer's view, Desert Express was a qualified success. The mission accomplished the primary goal-- fast express service to the theater. While there were the difficulties that occur when a new system is introduced coupled with some problems that have been in existence for many years, Desert Express' success exceeded USTRANSCOM planners' expectations. The average order and ship time (pipeline time) for a "show stopper" requisition (including backordered items) was trimmed to 11 days (compared to 18.4 days for 9BU). The 11 day figure included any possible backorders or depot repair (if such actions were necessary (Sledge, 1991).

One of the best indicators of mission effectiveness was the weapon system operation readiness (OR) rate. The Air Force, during the air campaign (16 January - 27 February 1991), flew several hundred sorties each day; in the first four days of the campaign, the allied coalition flew over 4000 sorties over Iraq (Church, 1991:22). With the increased flying level, it is logical that maintenance

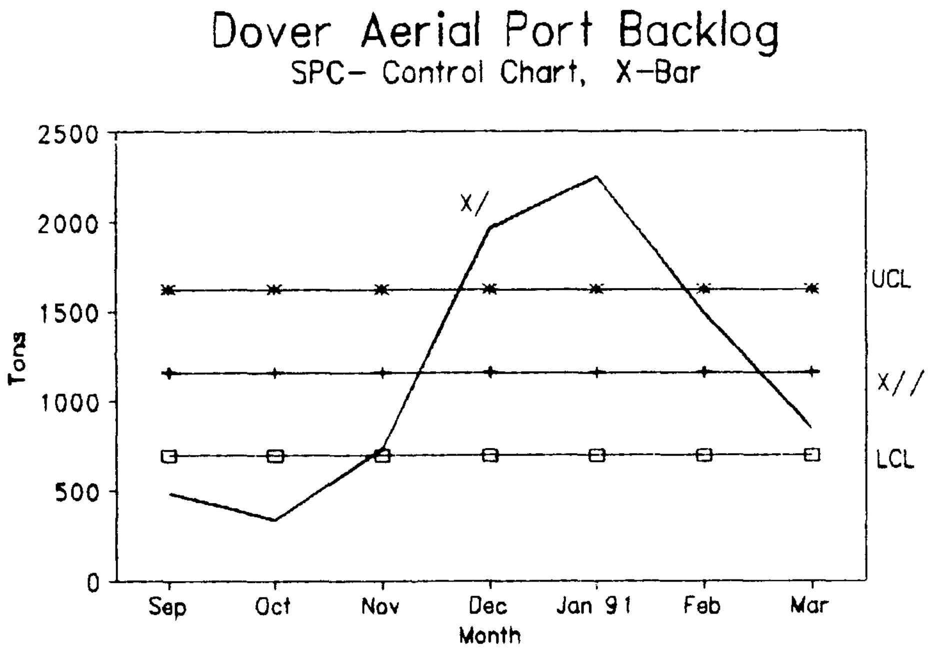

Figure 20. X-Bar Chart for Dover AFB Cargo Backlog (HQ MAC/TRK)

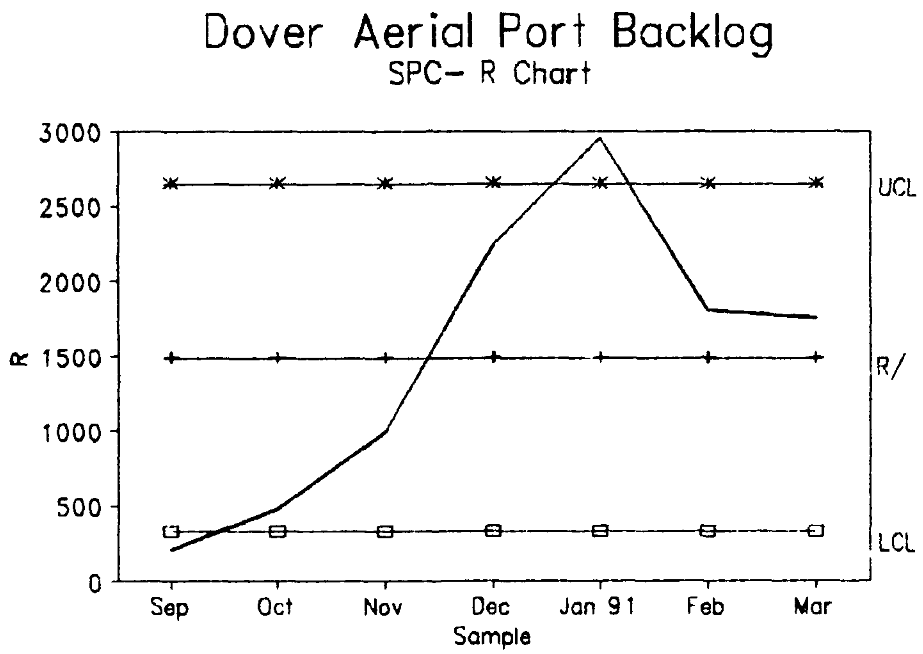

Figure 21. R Chart for Dover AFB Cargo Backlog (HQ MAC/TRK)

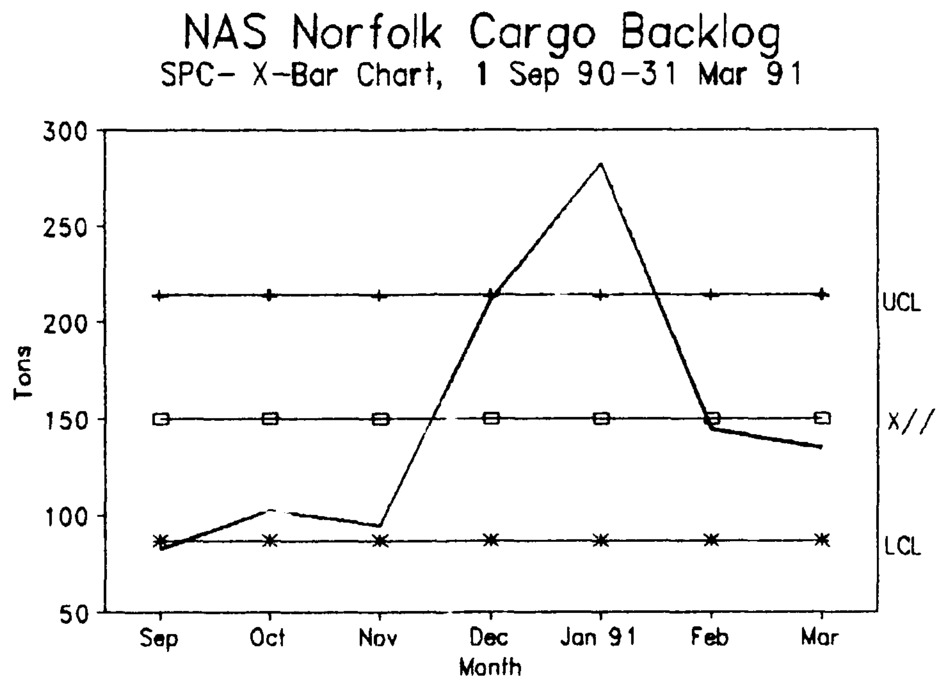

Figure 22. X-Bar Chart for NAS Norfolk Cargo Backlog (HQ MAC/TRK)

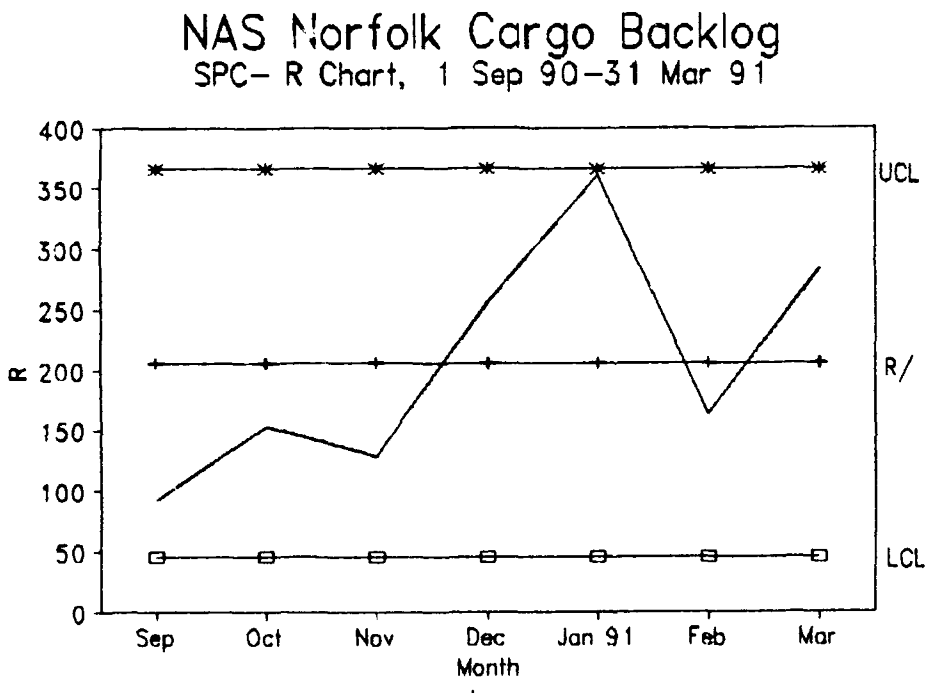

Figure 23. R Chart for NAS Norfolk Cargo Backlog (HQ MAC/TRK)

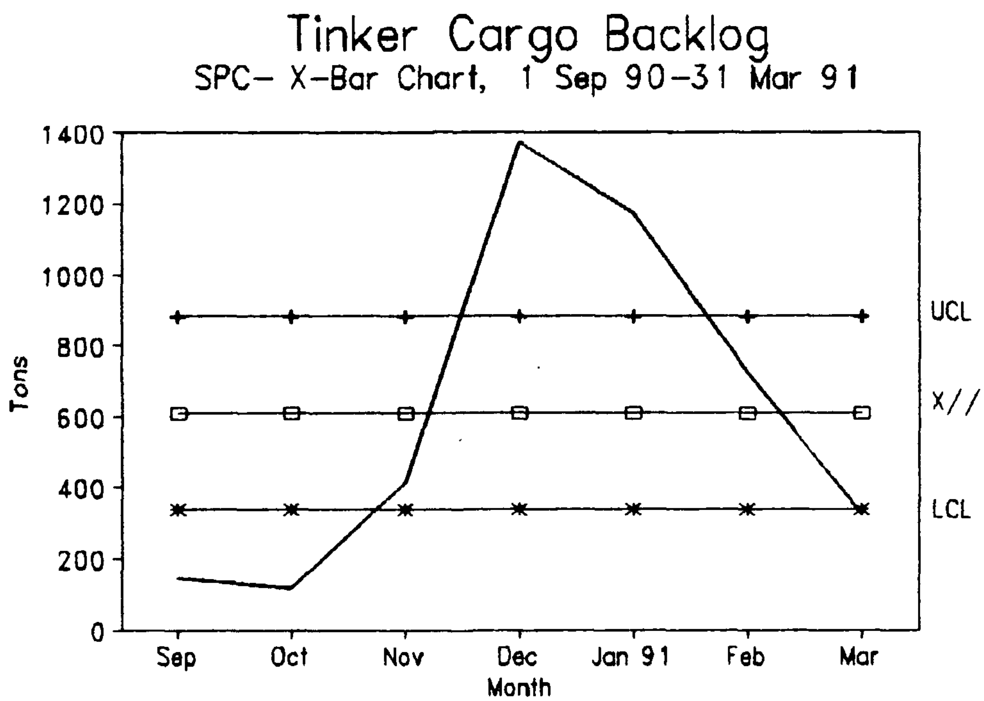

Figure 24. X-Bar Chart for Tinker AFB Cargo Backlog (HQ MAC/TRK)

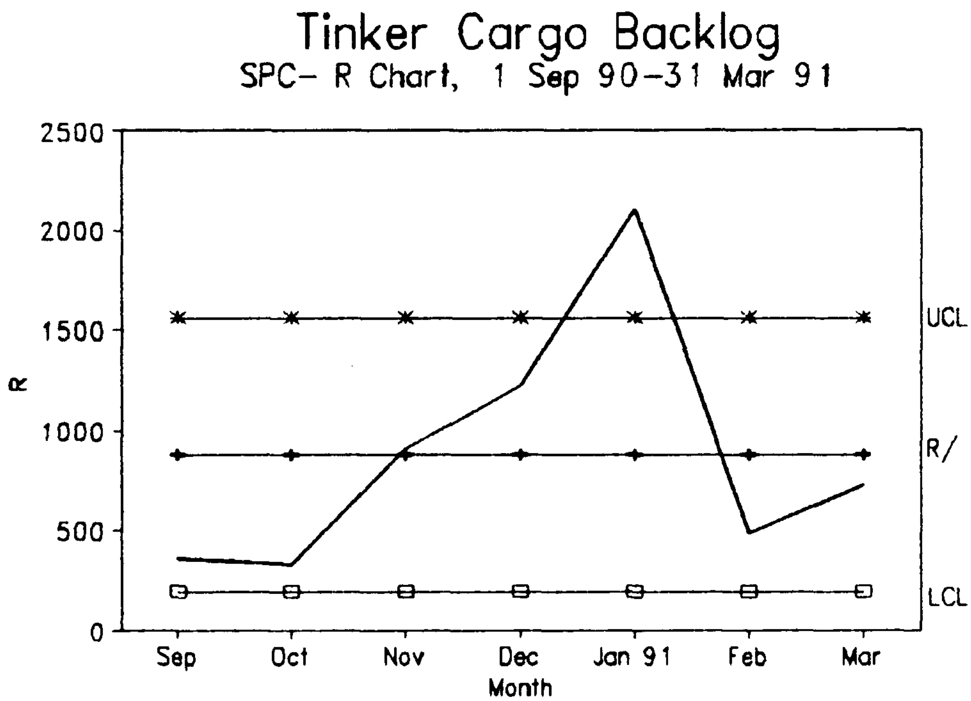

Figure 25. R Chart for Tinker AFB Cargo Backlog (HQ MAC/TRK)

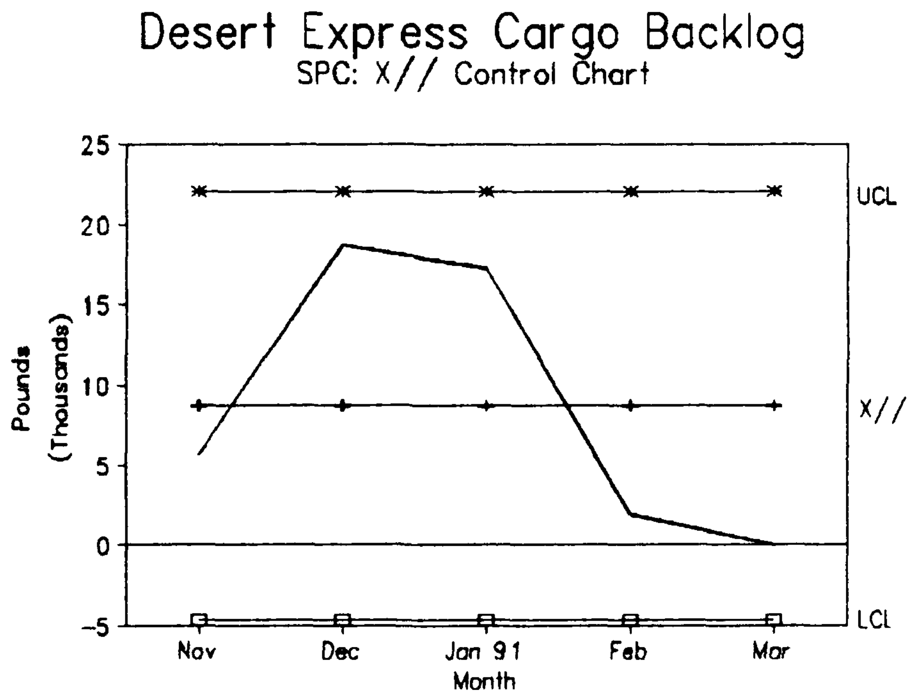

Figure 26. X-Bar Chart for Desert Express Cargo Backlog (HQ 21 AF)

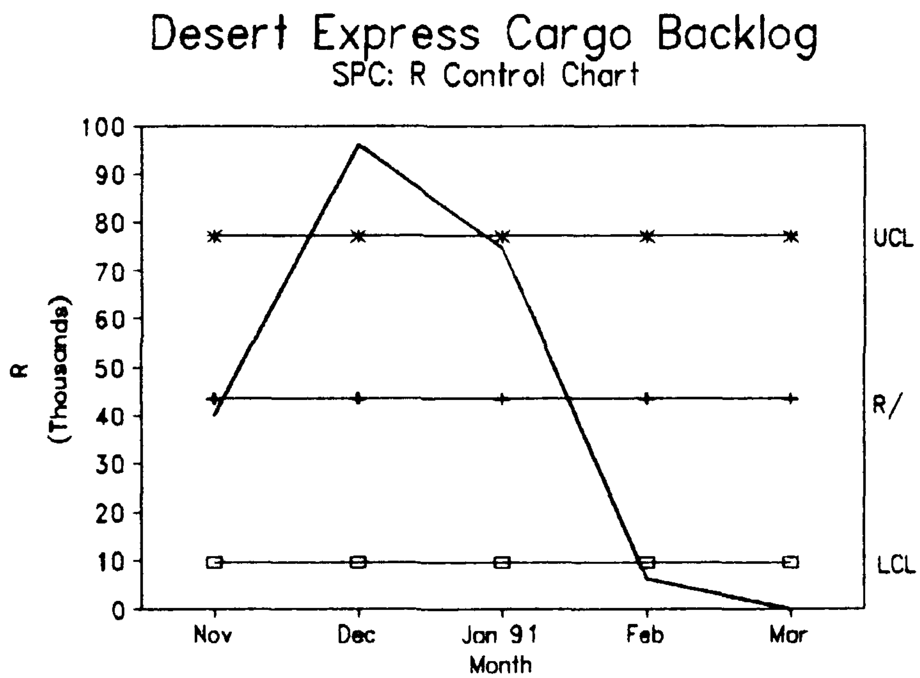

Figure 27. R Chart for Desert Express Cargo Backlog (HQ 21 AF)

activity will increase and the need for spares will proportionally increase. The OR rates were exceptionally high, more than 90%. Desert Express undoubtedly was a key element in keeping the flow of aircraft repair parts from CONUS moving rapidly (Livermore, 1991).

Desert Express paid additional dividends in terms of impression. The customer perceived that a problem existed in the air transportation system. Desert Express provided MAC with the opportunity to demonstrate a flexibility to alter operations to meet the customer's need. Intra-state transportation moving shipments to Charleston and intra-theater movement from the APODs to final destinations in the AOR was also responsive.

As impressive as the statistics for Desert Express were, the customer was not concerned with how a shipment was moved from the origin to Charleston or how communications allowed the Desert Express mission manifest to be electronically transmitted to Torrejon Air Base to be printed and waiting for the aircraft arrival. The customer was concerned with receiving the shipment when it was required. Desert Express provided the customer with desired time and place utility (Trempe, 1991). Senior transportation managers representing customer interests provided candid thoughts on Desert Express.

<u>The Army as Customer</u>. The Army was the second largest overall customer for Desert Express service. In a telephone interview, Major General Fred E. Elam, Assistant Deputy

Chief of Staff for Logistics, Department of the Army, provided the following thoughts.

He was pleased with the express service for the highest priority parts destined for the theater. The service filled a critical need for resupply for Army units building facilities in bare base situations. There were no prepositioned Army equipment or vehicles in Saudi Arabia. To General Elam, Desert Express was the opportunity to avoid lengthy delay in the current air transportation system for the highest priority cargo. Examples of "show stopper" items included: anti-fratricide kits (for vehicles), aviation spares, and medical items (especially antidotes for chemical exposure) (Elam, 1991). He also noted some areas of interest to Desert Express system management. Desert Express is very management intensive, as well as manpower intensive. The system needs a "sunset" clause-- the mission should terminate as soon as "prudent" and go back to routine channel mission operations. There was one major disappointment with the system-- shipment labeling. The bar code labels did not function as designed, resulting in the cargo processors manually loading shipment data into the database. As noted, this slowed cargo processing time. When asked about institutionalizing the Desert Express concept, General Elam felt the concept applied to contingency scenarios-- resupply in bare base situations, but not in the peacetime environment.

The Army's CONUS Airlift Clearance Authority is managed by Lt Col William Bevers, the Chief, Transportation Management Division at the Presidio, San Francisco, California. Lt Col Bevers provided similar thoughts on Desert Express. The premium transportation concept to the AOR was sound. On the average, Army customers received shipments in less than 48 hours (Bevers, 1991). It was noted that shipments bypassed established procedures for setting cargo priorities (Bevers, 1991; Elam, 1991). The U.S. Central Command Army Component (ARCENT) defined the basic "show stopper" part as an item required to repair a "deadlined" piece of equipment that is part of a weapon system (Bevers, 1991).

The only criticism of the Desert Express system: the need to bypass the current airlift "system" in order to get the "show stoppers" quickly to the AOR. Lt Col Bevers noted some difficulties in clearing cargo for the Desert Express mission. Initially, clearance procedures included daily facsimile transmissions between the Presidio and the MATCU at Charleston AFB. ARCENT established policy and procedures for tendering cargo to Desert Express. As it was in the Air Force, the Army had to work through the mission start up phase and smooth out the initial difficulties (Bevers, 1991).

<u>Navy and Marine Corps Customers</u>. The Navy and Marine Corps shipments were only 5% of 53,095 shipments (as of 31 March 1991) on Desert Express. A substantial portion of

Navy shipments, including high priority items, went on the channel mission from NAS Norfolk (Morley, 1991).

Air Force as a Customer. During the planning stages for Desert Express, it was estimated that the Army would be the largest customer. However, during Desert Storm, the Air Force actually had the largest number of shipments. Logically, if the ground war had been protracted, the number of Army shipments would have risen sharply.

Of the major air commands, TAC was the largest user. MAC used Desert Express to move MAC MICAPs. SAC had limited application as most of that command's deployed units were at locations not serviced by Desert Express. However, SAC used a similar concept, Mighty Express, employing organic airlift to move their priority cargo (Seale, 1991).

TAC transportation management was pleased with the Desert Express performance. Colonel Ronald W. Waggoner, TAC's Director of Transportation, noted that the Desert Express system was not saturated due to priority abuse (Waggoner, 1991). There were problems with priority abuse during the early stages; however these problems were limited through the use of positive shipment clearance (by the SSCO) and by the formation of the CSSA by CENTAF/rear. There was some hesitancy about the positive clearance policy for all Desert Express cargo; TAC transportation management favored more of a free flow of 9AU cargo to Charleston AFB. However, they found that the positive clearance was effective in limiting possible abuse of the priority system (Livermore, 1991).

TAC, as a customer, also had criticism for Desert Express. The service was limited to smaller items: no hazardous material, no engines, no courier, and no items that required "married" 463L cargo pallets. The restriction on engines and married pallets was later modified (Waggoner, 1991). In fact the change on married pallets came as a response to customer needs (Morley, 1991). Intransit visibility, from the customer's viewpoint, was very frustrating. Before AFLIF came on line, it was extremely difficult to trace a shipment, should it become lost "in the system". To improve visibility, the Charleston aerial port established a computer bulletin board, with the daily Desert Express manifest, that HQ TAC could access (Waggoner, 1991). The information provided assistance in tracing shipments. The introduction of AFLIF further enhanced the tracing capability.

Customers' View of the Pipeline and Desert Express. Colonel Waggoner also provided a customer's view about the Air Force logistics pipeline for the requisition and movement of the highest priority parts. The shippers and the traffic management offices need to be educated, early on, about the criteria for a "show stopper" item (Waggoner, 1991). This assumes that the theater commander, through the service components, has provided the criteria for "show stopper" items. For some customers, this was a difficulty

(Bevers, 1991). Any possible priority abuse of cargo moving on Desert Express, had to be controlled at the early stages of resupply operations. While the concept of positive cargo clearance (before moving cargo to Charleston) proved successful in limiting saturation, the procedures used to clear cargo (facsimile and telephone calls) must be improved. Such methods were labor intensive; the volume of shipments could saturate the system. There were several instances where the cargo moved enroute to Charleston while the shipper was trying to obtain clearance (Waggoner, 1991). During January 1991, the number of shipments increased to the point that a specific daily Air Force allocation would be filled by 7:30 A.M. of the day prior. MAC did fly some double missions and one triple mission between 15 and 21 January 1991 (see Figure 6). The cargo amount was still so great that AFLC started diverting 9AU cargo to Dover and Tinker AFBs to go on available channel missions (Waggoner, 1991). From the customer's viewpoint, this was a source of irritation when the expected transportation mode was to be Desert Express.

Other Improvement Areas. The system concept relied heavily on the use of premium commercial air express to move shipments overnight to Charleston. Initially, shippers were hesitant to use air express due to the expense. The issue of funding for Desert Shield/Storm support was not resolved right away (Waggoner, 1991; Mann, 1991). Bases with units deployed to the AOR, likely provided resupply items to their units. These bases likely used O & M funds to pay for air express service. Since O & M funding has been decreased, in general, there is some justifiable hesitation to use funds, needed to keep the base operating, to move "show stopper" items by premium transportation. In the early stages of Desert Express, this was reflected in the number of shipments that did not get to Charleston for the specific missions. Once the funding issue was resolved, the use of commercial air transportation increased. One customer recommended a military premium intra-CONUS transportation service to complement Desert Express (Waggoner, 1991).

The use of the yellow, circular label marking 9AU cargo was very good. The label "jumped" out to everyone in the transportation system-- this was an item that required the most expedient processing and movement. However, this type of label should only be used during a contingency scenario. It would also be helpful to have such labels prepared and stored for use if and when another contingency situation arises (Waggoner, 1991).

Conclusion

When the difficulties are set aside and an overall assessment is made, the Desert Express system accomplished what the planners anticipated. By in large, the customers (both shippers and receivers) were pleased with the quality and swiftness that supplies and equipment was moved to our forces in the Gulf. Yet, there are some issues to be addressed: Desert Express was a dedicated mission, airframes, and crews whose only purpose was to airlift the highest priority parts to the theater. Airlift is what MAC does on a daily basis. Why was Desert Express so successful? Does MAC have the capability to accomplish this type of operation with the current operation schedule?

VI. Desert Express Implications

Introduction

The overall reaction to Desert Express has been positive. Of the transportation management officials interviewed (both in MAC and AFLC), the mission was a resounding success. From the Air Force and Army customer point of view, the mission was also very successful. The mission amassed impressive statistics: 235 missions flown and 2663 tons (63,000 shipments) moved. The research question asks why the transportation system initiated this service during the Desert Shield? Apparently, there has been a long-term need for Desert Express. This chapter interprets the results of Desert Express, the implications on future logistics support, and how the military could operate the logistics pipeline.

Mission Effectiveness and Efficiency

The Desert Express impact on wartime logistics support is far-reaching. Before examining measures of effectiveness and efficiency, the terms require definitions.

Effectiveness. Webster's New Collegiate Dictionary defines effectiveness as: "...producing a decided, decisive, or desired effect: ready for service or action." (Woolf, 1974:362). An excellent effectiveness example came from the Air Force. Tactical Air Command's operational readiness rate was above 90% for many of the flying units (Correll, 1991:17). When the initial deployment for Desert Shield occurred in August 1990, one question addressed was: what would aircraft maintenance forces do after depleting the supply of aircraft from the War Reserve Spares Kits (WRSK)? (Mann, 1991). WRSK kits normally have 30 days spares supply. If this supply was exhausted and the supply units could not provide parts support, it was reasonable that maintenance personnel could cannibalize parts from similar aircraft that were awaiting a part(s) from the CONUS. This method of sourcing for reparables is only partially effective. The pipeline, from the part(s) source to the end user, must be able to supply the required part as quickly as possible. Desert Express, as the transportation arm of that pipeline accomplished this goal. Desert Express, as a complete system, accomplished this goal; it was effective. As a mission, was Desert Express efficient?

<u>Efficiency</u>. <u>Webster's New Collegiate Dictionary</u> defines efficiency as: "...(an) effective operation as measured by a comparison of production with cost (as in energy, time, and money)" (Woolf, 1974:362). In terms of cost recovery, how did Desert Express perform?

The cost for operating one Desert Express mission was approximately $115,000 (Morley, 1991). Using the distance between Charleston, South Carolina and Riyadh, Saudi Arabia, 11,511 miles, and using a 19.5 ton (39,000 lbs) aircraft cabin load, the ton/mile cost per mission was approximately $1.95187. Comparing this expense to the MAC contract rate for Federal Express to the same area, $0.45806 (Hamilton, 1991), Desert Express was not efficient. It was very resource intensive. For each mission departing Charleston, there was an additional airframe ready to take a mission should the primary airframe develop mechanical difficulties (Reeves, 1991).

Desert Express was labor intensive. There were dedicated aircrews for the mission. Aircrews changed at Torrejon Air Base, Spain, during the refueling stop. This required staging crews at Torrejon, an additional cost. At the aerial port at Charleston AFB, there were also personnel dedicated solely to Desert Express servicing (cargo loading, load planning, manifest preparation, delivering aircrew meals, etc). Aircraft maintenance personnel adjusted workloads to accommodate the priority Desert Express mission.

If efficiency were measured in terms of cost recovery for material and labor, the Desert Express mission did not appear efficient. For example, using the rate for an 1100 pound shipment moving from Dover AFB to Dhahran ($2.24 per pound-- there was no tariff rate between Charleston AFB and the Saudi Arabia (Mann, 1991)) and assuming each shipment was 1100 pounds, the revenue generated per mission would be approximately $87,360.00, based on a 39,000 pound aircraft cargo load. The difference between revenue and cost was $-27,640. Individual shipment weights varied. MAC likely lost money in terms of the cost recovery (West, 1991).

Efficiency, while having importance, was not the primary strategy.

Management emphasis centered on readiness preparation as a measure of effectiveness. The goal of the theater commander was to have the forces required to fulfill the war plan's goals. These forces must be ready to fight, if called upon. Preparation includes having the necessary equipment for forces to engage in combat as well as having the logistic support mechanism functioning. The costs for the dedicated airframes, aircrews and ground support personnel may be the costs for readiness (West, 1991).

Planning Changes

Desert Express marked a significant change in the way the military planned and executed logistics support during Desert Shield/Storm. The concept was successful in part because system planners established rules and guidelines and system operators enforced these rules and guidelines. The universal results of the system, while lauded, also provide the forum to ask some fundamental questions on the overall pipeline procedures.

Current Pipeline Procedures

The research question this analysis seeks to answer is: Why was Desert Express conceived? Airlift customers must have perceived that the current system for parts receipt did not meet customer needs. The primary perceived problem was the transportation portion of the pipeline, especially air transportation when used to move the 999/MICAP/"show stopper" parts. Desert Express proved that the air transportation system could deliver a part from the CONUS to the AOR in as little as 31 hours, depending on when the part arrived at Charleston AFB. This performance was also consistent, a critical element in providing the time and place utility customers desire.

If a new form of military express service was required and if that service was similar to service already provided by the MAC, then why was the express service needed? Once Desert Shield was underway, the cargo amounts at the aerial ports started building up. This eventually outstripped the available airlift. Figures 28 and 29 highlight the cargo backlogs at Dover AFB and Tinker AFB, the two major resupply aerial ports of embarkation (APOEs). The graphs indicate continual backlog increase. Most of the backlog at both ports was deployment support. A corollary challenge was the amount of the backlog being high priority (MICAP, 999, etc.) For example in a random data sample from the Tinker APOE, during January and February, 1991, an average of 57% of all DoD air qualified shipments were 999 priority. During the same period, 999 shipments, by weight, accounted for 81% of all Desert Shield/Storm shipments processed at Tinker. The data for these two months (for Tinker and Dover) includes 9AU shipments (marked for Desert Express) diverted from Charleston AFB to either Dover or Tinker AFBs (Figueroa, 1991).

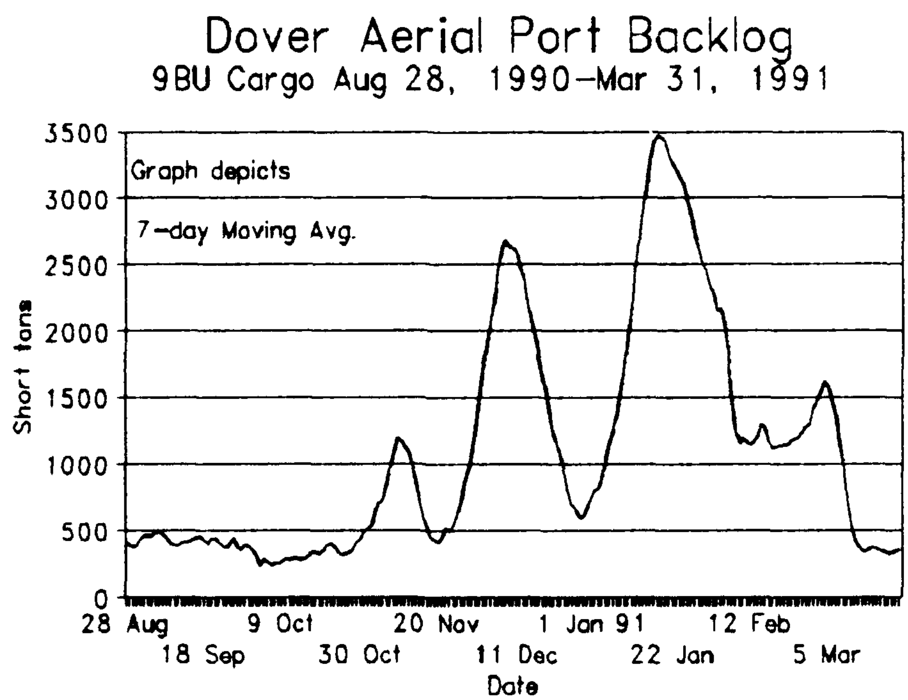

Figure 28. Dover AFB Cargo Backlog: Desert Shield/Storm (HQ MAC/TRK)

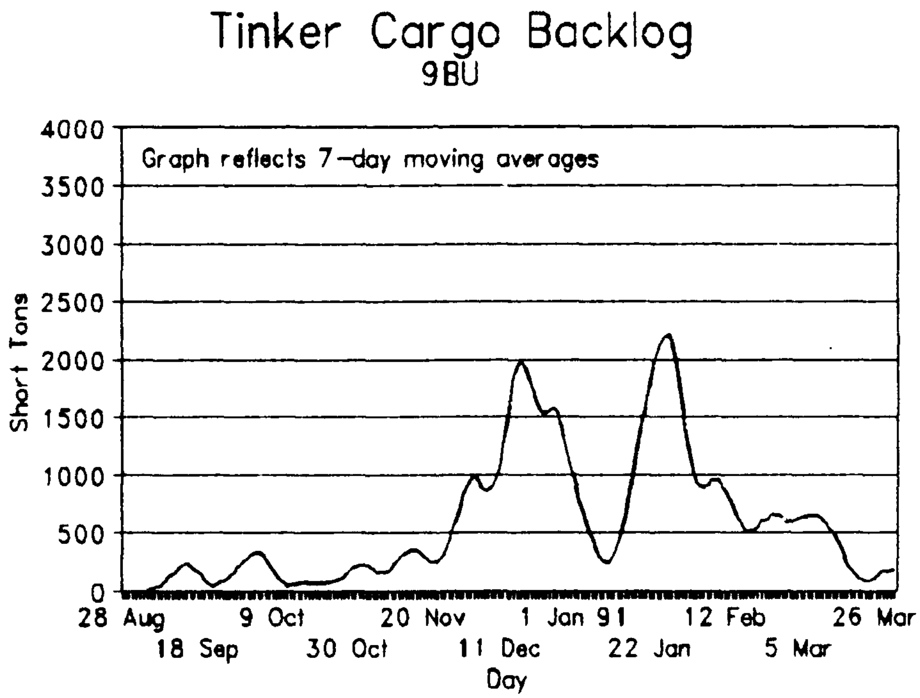

Figure 29. Tinker AFB Cargo Backlog During Desert Shield/Storm (HQ MAC/TRK)

The need, for either an express system or a method to segregate 999 cargo for rapid forwarding, is evident from the amount of 999/MICAP items destined to the AOR. From the averages presented above and from the interviews conducted, the challenge of moving the highest priority parts was very critical. This challenge goes back to a long-term problem in the entire transportation priority process. In the Air Force supply system, a requisition is given a priority. That priority denotes a specific transportation priority when the part is placed in the Defense Transportation System (DTS). The transportation priority system recognizes JCS-assigned project codes, however if the volume of 999 cargo is large, it creates a "no priority" situation (Sledge, 1991). Therefore, 999 cargo for one project code and 999 cargo for another project code awaiting movement, is handled in a manner similar to first-in-first-out. It is possible there may be a project that is more important than others; therefore it is desirable to move priority cargo for that project ahead of other priority cargo. There is no established method to highlight this cargo; the cargo moves as the airlift becomes available.

The use of the unique Desert Express shipping label was the first step toward the solution of shipment visibility during the cargo handling phase. This identification situation, combined with the sheer volume of 999 cargo and other priorities of cargo (for the specific project) and routine cargo (not related to the deployment), creates more cargo than airlift schedulers forecast. A backlog is created, cargo transit times increase, and the customer wonders why the system cannot meet the UMMIPS delivery standards.

The system currently used to requisition and receive parts, equipment, and supplies appears adequate for the peacetime environment. There are basic problems in that the established MILSTRIP and MILSTAMP priority directives have not been well enforced. The phraseology "priority abuse" was frequently voiced in most of the interviews with transportation managers (both from operators and customers). This signals a problem or a perceived problem with customers establishing priorities higher than directives warrant. The cargo statistics for Tinker AFB, cited earlier, indicated that in terms of shipment count, more than 50% of the shipments were 999 during January and February 1991. If this was indicative of other months during the Desert Shield/Storm operations and indicative of other APOEs, then there was a substantial amount of cargo with a higher priority than warranted. There is a need to either change the process of establishing cargo priorities or re-educate all customers on the problem of priority abuse and the need to follow established guidelines. All Air Training Command curricula for basic skill training should include units on customer understanding and use of the supply and transportation systems. It would benefit the supply and transportation communities to have the customer understand what can result if the system is changed to benefit a segment of the defense organization to the detriment of the rest of the organization.

Transportation Resource Constraint

The emphasis on proper cargo shipment priority stems in part from the amount of transportation resources available for all movement requirements. It is common knowledge to transportation planners, and emphasized in recent appraisals, that there is insufficient airlift to support the rapid force deployment strategy. When required, it becomes necessary to use the scarce airlift resources to move the first combat units into a theater of operation. Once the deployed units are in place, airlift becomes the primary mode for moving the highest priority resupply for the first few days of operations.

Desert Shield and Desert Storm presented an example of simultaneous deployment and resupply operations to the Gulf region coinciding with regular resupply operations to military locations worldwide. The entire Gulf deployment, which started in August, was not completed until February. Resupply operations competed with deployment operations for the scarce airlift resources from the beginning of Desert Shield. (Waggoner, 1991). There is a need for change in the method allocating airlift (the scarce resource). In the commercial transportation industry, the resource (a transportation mode) is distributed through charges for service (a market mechanism). The shipper pays the carrier for use of the carrier's equipment, operator, and specific service schedule. The cost of service, to a customer, is the carrier's costs (fixed and variable) to move a shipment from origin to destination. (McCauley, 1991). It also allows the carrier a reasonable profit for that carrier to remain in business.

Suggested Change for Peacetime Priority Movements. It was apparent that the current supply/transportation priority system fell victim to abuse. Desert Shield/Storm provides an excellent opportunity for recommending major changes in allocating transportation resources (especially air transportation). Immediately, a dilemma appears. In formulating any major changes to the supply or transportation systems, one has to address the two environments in which both systems operate: peacetime and contingency/emergency.

One suggestion for establishing a priority system for air cargo movement, in the peacetime environment, is adopting a "charge" for military premium transportation service (Sledge, 1991). For example, Federal Express has a premium overnight service to any of their destinations in the continental U.S., with a cost commensurate to that service. For a lower cost, Federal Express will provide a second day delivery service to the same destinations. The shipper can choose the type of service required to move a shipment within the shipper's schedule. With the changes to budgets now occurring in the Air Force, the wing (or group) will have a greater "voice" in determining how that organization's Operations and Maintenance (O&M) budget will be spent.

It may be possible for MAC to offer a premium express service within the channel system that now exists. Premium service would entail more rapid shipment handling at the aerial port and immediate movement on the first mission going to the aerial port of debarkation (APOD) nearest the shipment destination. The shipper would expect to a "pay" a higher tariff rate for such a service. MAC would guarantee the transit time for express shipments. The goal is to provide the shipping customer with a choice of transportation service. If the requirement (at the destination) is immediate, the shipper can pay a higher MAC tariff rate for the more immediate movement. If the requirement does not require the premium service, then there is the available air service that MAC currently provides. The cost factor should limit the possibility of priority abuse as the "cost" of premium transportation will consume a greater portion of a wing's O&M budget. This is possible in a peacetime environment; can it work in a contingency scenario?

<u>Contingency Premium Transportation</u>. Logically, in a peacetime environment where transportation assets may be scarce, a market-style pricing scheme would serve to allocate available resources. However, when the environment

changes to a contingency situation, several challenges arise. One critical challenge is deployed force readiness posture. Deploying Air Force aircraft units carry 30 days supply of spare parts to maintain unit aircraft. The war reserve spares kit (WRSK) is comprised of these spares. The WRSK is designed for use until the deployed supply organization is in place and able to issue items. As the spares are expended, the unit must have the lines of communication established in order to procure replacements. Maintenance units depend on supply for parts and cannot "live" out of the WRSK. With readiness being the major incentive to have all equipment and personnel in combat posture, the logistics system must provide the critically required material when and where it is needed. From observations of Desert Shield/Storm, the logistics system managers are concerned with effectiveness more than efficiency. Desert Express was an excellent example (Eddy, 1991; West, 1991). Given this scenario, the cost allocation of transportation resources might appear inappropriate.

The challenge that Desert Express highlighted is the lack of airlift resources to move everyone and everything required in the beginning stages of a deployment. In focusing on cargo transportation, there are two separate environments: peacetime and contingency. In the peacetime environment, there is generally airlift available to move 999, Transportation Priority (TP) 1 and TP 2 cargo. The transportation control number (TCN) is the basic unit of movement and movement decisions are controlled by fund availability. In a contingency environment, tonnage becomes the unit of movement and the supported CINC's requirements becomes the allocation catalyst (Sledge, 1991). On the surface, using cost of service to allocate airlift and curb transportation priority abuse, appears counterproductive. However, upon closer examination, using tariff charges to allocate airlift can be feasible. During Desert Shield/Storm, the additional funds to support defense and contingency operations were slow in coming to unit levels. This was seen in the data of CONUS transportation support to Charleston AFB for Desert Express. Once that situation was resolved, shippers were willing to use premium air express to move priority parts to the Desert Express APOE. The opportunity for priority abuse also increased.

As the Air Force moves to the concept of wings "paying" for services that were once funded by other sources, it should be possible for the Air Staff and MAJCOMs to allocate additional contingency funds to each wing/group with units deployed to a theater. This differs from the policy of having a single fund cite that all units use to procure goods and services related to the deployment. If a wing must "pay" for premium transportation (both commercial CONUS and military "express"), it would limit cargo priority abuse. Obviously, the goal is to get the necessary items to the forward units as quickly as possible. However, under Desert Shield/Storm conditions, there were so many items that had high priority that Desert Shield channel APOEs were choked. If the system slows, rapid delivery for high priority cargo does not happen. The question of using cost to allocate transportation resources and the question of the unit "paying" for priority movement for contingency support merits further study.

Transportation in Two Environments

Despite the philosophy of conducting peacetime operations as training for wartime operations, a delineation exists between the peacetime environment and the contingency environment. A good example of this difference occurred during Desert Shield/Storm in the transportation arena. Deploying unit equipment entered the transportation system using the unit increment numbers. Base supplies and Air Logistics Centers (ALCs) sent resupply and sustainment cargo using the MILSTAMP rules. There were instances when unit cargo became separated (by accident or by necessity) from the deploying unit and diverted to a channel APOE for shipment. The cargo unit increment number was not compatible with the aerial port automated data system. Port cargo personnel completed appropriate MILSTAMP documentation. This additional activity added to the overall transit time for cargo and left a forward unit without required equipment and supplies vital to combat posture.

The Unit Line Number system is inadequate due to insufficient use or lack of training in proper use (Waggoner, 1991). The system lacks flexibility when an operation does not go according to plan (Sledge, 1991). MILSTAMP procedures should be implemented for deployment operations as well as peacetime, resupply, or sustainment operations. A recent change to MILSTAMP merged the Unit Line Number system into the Transportation Control Number system. This is a major step in forming a single system for operation in contingency and peacetime circumstances.

Peacetime versus Contingency Transportation Systems

The Air Force community, at the base level, perceives two different transportation systems-- one for the routine peace time cargo and passenger movement and one for contingency operations. One interviewee commented that the peacetime airlift system was not prepared to accommodate the increased cargo input (Mims, 1991). There should only be one system for processing and moving cargo, whether in peacetime or contingency. Changing this perception is imperative. There is one DoD transportation system to use in all circumstances. The changes to regulations (e.g., combining deployment cargo identifiers with MILSTAMP TCN format) should be implemented. More training through deployment exercises will assist in changing this perception. Training will reinforce the customers' and the system operators' focus on preparing for contingency movement (Mims, 1991; Waggoner, 1991).

Additional Lessons and Implications

There are some additional lessons that have been learned and will likely require further emphasis. The "mind set" of "throwing the book away" when shipping resupply or sustainment cargo, must change. The 9BU (Desert Shield/Storm) project code cargo statistics clearly indicate that established MILSTAMP rules will work if they are followed. Several messages reminded shippers to adhere to MILSTAMP procedures to assist in timely cargo movement. The idea of disregarding the rules led to greater problems with lost audit trails and greater cargo invisibility. When cargo "disappears," the deployed unit continues to requisition needed items, placing additional burden on the system (in both the supply and transportation portions). Once again, education and training may be the answer of choice.

In an interview with SMSgt Thomas P. Donovan, a Desert Express supervisor with the 437 Aerial Port Squadron, one significant idea surfaced. If there is a consistent pattern of difficulties for customers and transportation operators in applying MILSTAMP procedures, perhaps the system requires modification. In a proposed afteraction report, SMSgt Donovan suggested major changes in the way cargo is processed for air shipment. This may entail significant changes to the MILSTAMP regulation (Donovan, 1991). While MILSTAMP procedures appear uncomplicated, a change would be helpful if it solves the difficulties that create cargo backlogs in contingency situations.

Training Need. With the need to end the perception of two different transportation systems, there is an urgent requirement for the logistics community to train and to educate the military community in supporting rapid force deployments in situations similar to Desert Storm. Planners can use the logistics data from Desert Shield/Storm to conduct computer simulations and improve support plans. These plans provide the basis for conducting mobility exercises. Command post exercises as well as deployment operations, with support forces exercising the pipeline, will better prepare the total force for future operations.

The Desert Express system operated with the following variable: the supported CINC determines critical readiness needs. The service components interpreted this guidance and determined what constituted "show stopper" items. The supported CINC eventually determined the aircraft allocation for each service component (Elam, 1991; Wang, 1991). This action should continue.

Implications. The Desert Express system has proven successful in the deployment/contingency environment. The entire process must be institutionalized in DoD guidance as a contingency system. Activity in the peacetime environment does not warrant a day-to-day package express system to overseas locations. MAC has missions that cover Europe and the Pacific on a daily basis. However, there are processes learned that have application in the peacetime environment.

The AFLIF system has provided virtual intransit visibility, accessible with a personal computer and modem, from anywhere in the world. This is just one example of information management that the military transportation community requires. The use of bar code strips on packages may be an answer to quicker cargo processing at aerial ports and seaports.

To manage information, the computer hardware and software must be able to handle cargo data-- both in peacetime and in the surge scenarios. The ADAM III system was so saturated that certain programs were curtailed so the computer could operate other vital programs. The military may have to spend the additional funds to procure capable hardware and software to improve transportation data systems. These systems must be capable of increased workload during surge operations (that take place in a major force deployment).

Priority abuse was evident in moving 9BU cargo. In the early days of Desert Shield and throughout the entire Desert Shield/Storm operation, there were inordinate amounts of 999 in the three aerial ports (Dover and Tinker AFBs and NAS Norfolk). In effect, there was a "no priority" called 999. Much of this cargo should have been set at a lower transportation priority. Education and training can attempt to solve this problem, however history has shown that education and training have had little effect on the problem. It is time to look at alternative methods to establish transportation priorities and ultimately to allocate transportation resources. The cost allocation for cargo shipment, where the shipping agency "pays" for the transportation service required, is needed. It is possible for cost allocation to be applicable in peacetime and contingency. Funds required from Congress would be allocated to wings/groups involved in the deployment instead of being in one "pot" of money that all agencies draw upon. Such a system for setting transportation priorities may require separating the transportation priority system from the supply system.

The perception of two separate transportation systems -- one for peacetime and one for contingencies-- must be quelled. Daily peacetime operations, mobility training, and deployment operations, must use the same procedures to prepare, document, and move cargo and passengers. The documentation process must be standardized for ALL situations. The recent changes to MILSTAMP and the blending of the mobility cargo increment number with the transportation control number are steps in the right direction. If necessary, the "MILS" should be rewritten to address operations under all situations.

Conclusion

Desert Express provided a good empirical example of how the future logistics system may provide support to forward deployed forces. While Operation Desert Shield was active for almost five and one-half months, it appears more likely when the U.S. armed forces respond to a low intensity conflict, there may not be the long lead time that forces enjoyed in the Gulf War. The logistics pipeline had ample time to support combat forces' preparations for hostilities. Should U.S. forces deploy into an immediate hostile situation, the logistics system can face immediate simultaneous deployment and sustainment situations of great magnitude. Once again, customers will have to "compete" for the scarce airlift resources to move deploying forces and priority sustainment supplies.

Having a rapid response pipeline can ease the burden of for deployed supply personnel. In a combat situation, the deployed unit must be able mobilize on short notice. An excessive inventory at the supply point will add to the burden of the local logistics network to move the deployed base if it becomes necessary. It also will add to the difficulty of maintaining accountability for the inventory.

Rapid response capability can assist war planners in determining the number of mission capable weapon system assets required to accomplish a tactical plan. Statistical information on the mean time between failures for components in weapon system and the dependability of the pipeline to deliver replacements, provides the commanders and planners with accurate estimates of the number of aircraft required to accomplish tactical objectives.

Appendix A: Statistical Process Control

The data and formulas for the statistical process control testing are depicted on the following pages. Data were randomly selected from the 9BU cargo backlog statistics for Dover AFB, Tinker AFB, and Naval Air Station, Norfolk. For each of the months of Desert Shield and Desert Storm, 10 data points were selected from the entire month of daily backlog figures. For each month, the figures for calendar days 3, 6, 9, 12,....30 were used. For February, the sequence was: ...24, 27, and 28-- with only 28 days, calendar day 28 was substituted for calendar day 30.

X-bar and R Charts. The steps and formulas for building the X-bar chart are (Brassard, 1988:53):

1) Sample average:

$$\bar{X} = (\bar{X}_1 + \bar{X}_2 + ... + \bar{X}_n)/n \qquad (1)$$

n = number of observations in the subgroup.

2) Find the range of each subgroup:

$$R = X_{max} - X_{min} \qquad (2)$$

3) Calculate the average range (R) and the process average (X-double bar)

$$\bar{R} = (R_1 + R_2 + ... + R_k)/k \qquad (3)$$

$$\bar{\bar{X}} = (\bar{X}_1 + \bar{X}_2 + ... + \bar{X}_k)/k \qquad (4)$$

k = # of subgroups

4) Calculate the upper and lower control limits for X-bar and R.

UCL is the Upper Control Limit.

LCL is the Lower Control Limit.

A sub 2 is a factor for the X chart, based on a subgroup of 10: 0.308.

D sub 3 is a factor for the lower control limit for the R chart (0.223 for n = 10) and D sub 4 is a factor for the upper control limit for the R chart (1.777 for n = 10).

$$UCL_{\overline{X}}=\overline{\overline{X}}+A_2\overline{R} \qquad (5)$$

Equation for Upper Control Limit- X-bar Chart

$$LCL_{\overline{X}}=\overline{\overline{X}}-A_2\overline{R} \qquad (6)$$

Equation for Lower Control Limit- X-bar Chart

$$UCL_R=D_4\overline{R} \qquad (7)$$

Equation for Upper Control Limit- R Chart

$$LCL_R=D_3\overline{R} \qquad (8)$$

Equation for Lower Control Limit- R Chart

The X-bar and R charts for Dover AFB, Tinker AFB, and NAS Norfolk cargo backlogs (both 9BU and any diverted 9AU cargo, in tons) and the backlog for Desert Express cargo (9AU, in pounds) are in chapter V. The sample data for the three bases are included.

Data for SPC
Dover Cargo Backlog

Cargo weights in tons.

Sep	490	527	493	599	409	476
Oct	597	435	228	120	271	289
Nov	435	737	384	1233	1378	1052
Dec	1490	1597	1957	2434	2906	2399
Jan 91	625	1122	992	1535	1996	2604
Feb	2246	2431	1829	629	2034	1247
Mar	1308	1351	1662	1875	192	468

Sep	430	529	392	478
Oct	256	489	523	152
Nov	581	464	465	567
Dec	2392	2078	1654	664
Jan 91	3412	3574	3339	3293
Feb	925	1206	1300	1040
Mar	252	476	127	410

X/	Avg of R
482.3	207
336	477
729.6	994
1957.1	2242
2249.2	2949
1488.7	1802
842.1	1748

X// = 1155

R/ = 1488.43

UCL X/ = 1616.41
LCL X/ = 693.59

UCL R = 2649.40
LCL R = 327.45

Data For SPC
Tinker AFB Cargo Backlog

Cargo weight in tons.

Sep	0	64	194	334	98.5	13	77
Oct	316	46	7	93	27	47	56
Nov	126	149	237	354	365	202	293
Dec	1026	850	1467	2030	1978	1286	1772
Jan 91	332	157	295	917	1355	1894	2190
Feb	955	951	906	472	533	646	848
Mar	827	696	636	235	140	101	113

Sep	114	212	355.5
Oct	79	175	335
Nov	461.67	917	1036
Dec	1527	992	806
Jan 91	2266	1507	802
Feb	714	608	603
Mar	164	204	116

Avg x/	Range R
146.2	355.5
118.1	328
414.067	910
1373.4	1224
1171.5	2109
723.6	483
323.7	726

X// = 610.081

R/ = 876.5

UCL X/ = 881.796
LCL X/ = 338.366

UCL R = 1560.17
LCL R = 192.83

Data For SPC
NAS Norfolk Cargo Backlog

Cargo weight in tons.

Sep	104	66	57	136	114	44	88
Oct	119	112	86	163	92	123	27
Nov	58	116	22	28	103	113	140
Dec	236	252	244	224	255	328	178
Jan 91	138	148	297	332	203	188	352
Feb	197	235	204	101	71	102	90
Mar	260	305	255	147	83	144	22

Sep	62	69	82
Oct	177	100	24
Nov	113	99	150
Dec	182	72	141
Jan 91	404	499	260
Feb	97	187	160
Mar	24	41	67

X/	Avg of R
82.2	92
102.3	153
94.2	128
211.2	256
282.1	361
144.4	164
134.8	283

X// = 150.1714

R/ = 205.2857

UCL X/ = 213.81
LCL X/ = 86.53286

UCL R = 365.4086
LCL R = 45.16286

Data For SPC
Desert Express Cargo Backlog

Cargo weight in pounds.

Desert Express Backlog

	Date	Navy	USMC	USAF	Army	Total
Nov	3	0	0	0	0	0
	6	0	0	0	0	0
	9	0	0	0	39993	39993
	12	0	0	0	0	0
	15	0	0	0	0	0
	18	0	0	0	0	0
	21	0	1685	1703	3383	6771
	24	0	0	0	3070	3070
	27	0	0	57	6330	6387
	30	0	45	339	223	607
Dec	3	0	45	105	34	184
	6	0	0	782	200	982
	9	0	0	0	0	0
	12	0	0	14	819	833
	15	0	0	0	4829	4829
	18	4526	2830	928	87808	96092
	21	418	262	10449	50847	61976
	24	0	0	249	0	249
	27	6	0	74	11490	11570
	30	0	0	1273	9110	10383
Jan 91	3	1	351	953	480	1785
	6	6	358	954	3575	4893
	9	5012	3039	16755	6799	31605
	12	4000	1000	12700	56873	74573
	15	0	0	2600	3400	6000
	18	0	128	3237	6293	9658
	21	1071	0	6804	1534	9409
	24	1718	693	12911	11183	26505
	27	0	0	0	0	0
	30	409	348	3521	3849	8127
Feb	3	0	0	1796	4383	6179
	6	38	159	1481	312	1990
	9	448	62	2553	736	3799
	12	110	30	811	1316	2267
	15	0	0	521	732	1253
	18	0	0	0	0	0
	21	8	0	521	324	853
	24	0	0	0	0	0
	27	0	0	0	0	0
	28	2880	0	0	0	2880
Mar	3	0	0	0	0	0
	6	0	0	0	0	0

9	0	0	0	0	0
12	0	0	0	0	0
15	0	0	0	0	0
18	0	0	0	0	0
21	0	0	0	0	0
24	0	0	0	0	0
27	0	0	0	0	0
30	0	0	0	0	0

	X/	R
Nov	5682.8	39993
Dec	18709.6	96092
Jan 91	17255.5	74573
Feb	1922.1	6179
Mar	0	0

X// = 8714.04

R/ = 43367.4

UCL X/ = 22071.2

LCL X/ = -4643.12

UCL R = 77063.87
LCL R = 9670.93

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Vita

Major Thomas C. Thalheim was born 20 July 1956 in Flint Michigan. He graduated from Southwestern High School in Flint, Michigan in 1974 and attended Olivet Nazarene University, graduating in 1978 with a Bachelor of Arts Degree in Biblical Literature. He received his commission through Officer Training School in 1979. He was first assigned to the 379th Transportation Squadron, Wurtsmith AFB, Michigan, as the Traffic Management Officer and Assistant Vehicle Maintenance Officer. In 1981, he was assigned to the 435th Aerial Port Squadron, Rhein Main AB Germany, as an Air Terminal Operations Duty Officer, and Squadron Vehicle Control Officer/Combat Mobility Chief of Vehicle Operations and Maintenance. Maj Thalheim cross trained into the Logistics Plans career field in 1985, where he became assistant chief of the 314th TAW Resource Plans Division (Little Rock AFB, Arkansas). In 1986, he was assigned to the 39th Tactical Group, Resource Plans Division, Incirlik Common Defense Installation, Turkey, as Mobility Officer, and Assistant War Reserve Material Officer. In 1988, Maj Thalheim went to the 1776th Transportation Squadron, Andrews AFB, Washington DC, as Vehicle Operations Officer, in charge of the second largest vehicle fleet in MAC.

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
September 1991

3. REPORT TYPE AND DATES COVERED
Master's Thesis

4. TITLE AND SUBTITLE
DESERT EXPRESS: AN ANALYSIS ON IMPROVED CUSTOMER SERVICE

5. FUNDING NUMBERS

6. AUTHOR(S)
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Air Force Institute of Technology,
WPAFB OH 45433-6583

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/GLM/LSR/91S-64

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Director of Transportation
HQ AFLC/LGT
Wright-Patterson AFB OH

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
Operation Desert Shield/Storm provided an opportunity to test the planning for U.S. forces to operate in a low intensity conflict. Both operations provided the opportunity for the logistics community to observe how the support forces provided the required supplies to the forward combat forces. In response to customers' requests, the U.S. Transportation Command created Desert Express, a daily "package express flight from Charleston, SC to Saudi Arabia. The research question addresses the "how" and "why" Desert Express came about. Additional investigative questions cover the following: mission objectives, planners' and customers' expectations, system performance, and implications on the Defense Transportation System. One major finding, the Desert Express system was successful. Equally important, the customer perceived that the system worked. Processes that evolved during mission execution, have applicability in the day-to-day peacetime environment.

14. SUBJECT TERMS
Frequency, Airlift Operations, Air Transportation, Military Transportation, National Transportation System

15. NUMBER OF PAGES
160

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev 2-89)
Prescribed by ANSI Std Z39-18
298-102

AFIT Control Number AFIT/GLM/LSM/91S-64

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